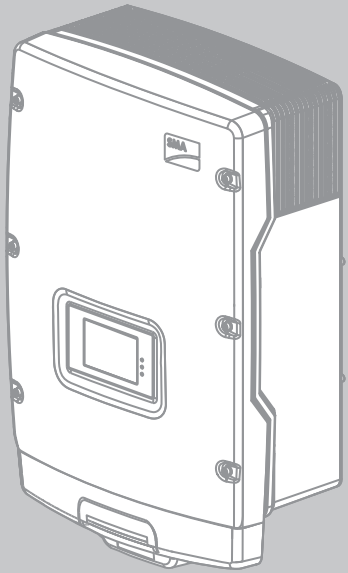
PV inverter

SUNNY TRIPOWER
5000TL / 6000TL / 7000TL / 8000TL / 9000TL

Installation Manual



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1 Information on this Document

Validity

This document is valid for the following device types as of firmware version 2.00:

- STP 5000TL-20
- STP 6000TL-20
- STP 7000TL-20
- STP 8000TL-20
- STP 9000TL-20

Target Group

This document is intended for skilled persons. Only skilled workers are allowed to perform the tasks set forth in this document (see Section 2.2 "Qualification of Skilled Persons", page 11).

Additional Information

For further information, see www.SMA-Solar.com:

Document title	Document type
Insulation resistance (R_{iso}) of non-galvanically isolated PV plants	Technical description
Criteria for Selecting a Residual-Current Device	Technical information
Miniature Circuit-breaker	Technical information
Measured Values and Parameters	Technical description
Module Technology	Technical information
SMA *Bluetooth* – SMA *Bluetooth*® Wireless Technology in Practice	Technical information
SMA *Bluetooth*® Wireless Technology	Technical description
Temperature Derating	Technical information

Symbols

Symbol	Explanation
⚠ DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury
⚠ WARNING	Indicates a hazardous situation which, if not avoided, could result directly in death or serious injury
⚠ CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE	Indicates a situation which, if not avoided, could result in property damage
i	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates an essential requirement for achieving a specific goal
☑	Desired result
✖	A problem that might occur

Typographies

Typography	Usage	Example
bold	• Display messages • Elements of a user interface • Parameters • Connections • Elements to be selected • Elements to be entered	• Select the **Fan test** parameter and set to **1**.
>	• Connects several elements that are to be selected	• Select the parameter group **Plant Communication > Speedwire**.

Nomenclature

Complete designation	Designation in this document
Torque	Torque
Electronic Solar Switch	ESS
PV plant	Plant
SMA *Bluetooth*® Wireless Technology	*Bluetooth*
Sunny Tripower	Inverter, product
SMA Webconnect function	Webconnect function

Abbreviations

Abbreviation	Designation	Explanation
AC	Alternating Current	–
DC	Direct Current	–
EC	European Community	–
EMC	Electromagnetic Compatibility	–
LED	Light-Emitting Diode	–
MPP	Maximum Power Point	–
MSL	Mean Sea Level	–
NetID	Network Identification	Identification number for SMA *Bluetooth* network
PE	Protective Earth	Protective conductor
RID	Registration Identifier	Registration key for registration in Sunny Portal
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e.V.	Association for Electrical, Electronic and Information Technologies

2 Safety

2.1 Intended Use

The Sunny Tripower is a transformerless PV inverter with two MPP trackers, which converts the direct current of the PV array into grid-compliant three-phase current and feeds it into the electricity grid.

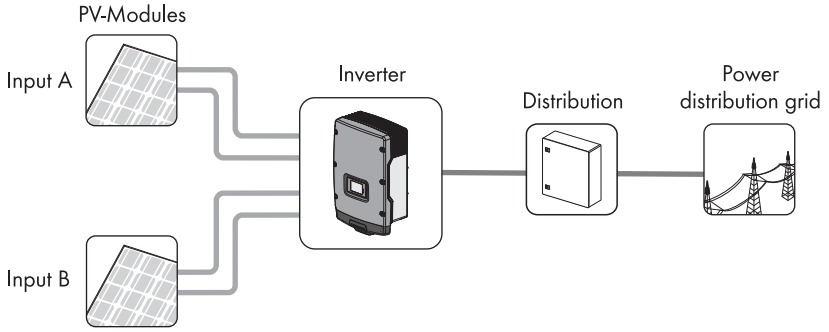


Figure 1: Design of a PV plant with Sunny Tripower

The Sunny Tripower is suitable for indoor and outdoor use.

The Sunny Tripower may only be operated with PV arrays (PV modules and cabling) of protection class II. The PV modules used must be suitable for use with the Sunny Tripower and must be approved by the module manufacturer.

PV modules with large capacities to earth may only be used if their coupling capacity does not exceed 1.25 µF.

All components must remain within their operating ranges at all times.

Alternative uses of the Sunny Tripower not expressly recommended by SMA Solar Technology AG are not permitted.

For safety reasons, it is not permitted to modify the product or install components that are not explicitly recommended or distributed by SMA Solar Technology AG for this product.

- Do not mount the Sunny Tripower on flammable construction materials.
- Do not mount the Sunny Tripower near highly flammable materials.
- Do not mount the Sunny Tripower in potentially explosive atmospheres.

The enclosed documentation is an integral part of this product.

- Read and observe the documentation.
- Keep the documentation in a convenient place for future reference.

2.2 Qualification of Skilled Persons

The tasks described in this document are intended for skilled persons only. Skilled persons must have the following qualifications:

- Knowledge of how an inverter works and is operated
- Training in how to deal with the dangers and risks associated with installing and using electrical devices and plants
- Training in the installation and commissioning of electrical devices and plants
- Knowledge of all applicable standards and directives
- Knowledge of and adherence to this document and all safety precautions

2.3 Safety Precautions

Electric Shock

High voltages that can cause fatal electric shocks are present in the live components of the inverter.

- Prior to performing any work on the inverter, disconnect it from any voltage source as described in this document (see Section 10).

Touching an unearthed PV module or an array frame can cause a fatal electric shock.

- Connect and earth the PV modules, array frame and electrically conductive surfaces so that there is continuous conduction. Observe the applicable local regulations.

Burn Hazards

Some parts of the enclosure can become hot during operation.

- During operation, touch the inverter on the enclosure lid only.

Electrostatic Discharge

Touching electronic components can cause damage to or destroy the inverter through electrostatic discharge.

- Earth yourself before touching any components.

3 Scope of Delivery

Check the delivery for completeness and any externally visible damage. Contact your specialist dealer if the delivery is incomplete or damaged.

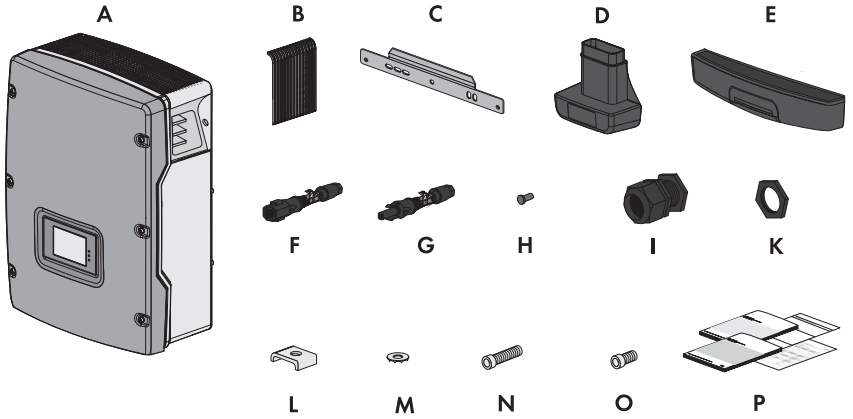


Figure 2: Components included in delivery

Position	Quantity	Description
A	1	Inverter
B	2	Ventilation grid
C	1	Wall mounting bracket
D	1	Electronic Solar Switch
E	1	Protective cover
F	4	Negative DC connector
G	4	Positive DC connector
H	6	Sealing plug
I	1	M32x1.5 cable gland
K	1	Counter nut
L	1	Clamping bracket
M	2	Conical spring washer*
N	2	M6x16 cheese-head screw*
O	2	M6x8 cheese-head screw
P	1	Installation manual, user manual, document set with explanations and certificates, supplementary sheet with the default settings

* 1 spare part for the enclosure lid included

4 Product Description

4.1 Sunny Tripower

The Sunny Tripower is a transformerless PV inverter with two MPP trackers, which converts the direct current of the PV array into grid-compliant three-phase current and feeds it into the electricity grid.

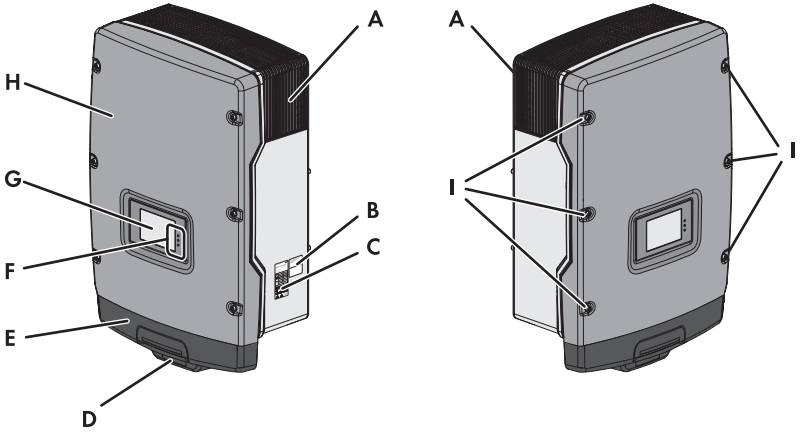


Figure 3: Design of the Sunny Tripower

Position	Description
A	Ventilation grids
B	Additional sticker on the type label
C	Type label
D	Electronic Solar Switch
E	Protective cover
F	LEDs
G	Display
H	Enclosure lid
I	Screws and conical spring washers of the enclosure lid

Symbols on the Inverter

Symbol	Description	Explanation
	Inverter	This symbol defines the function of the green LED. The green LED indicates the operating state of the inverter.
	Observe the documentation	This symbol defines the function of the red LED. The red LED indicates an error. Read this document to remedy the error.
	Bluetooth	This symbol defines the function of the blue LED. The blue LED indicates that communication via *Bluetooth* is activated.
	QR Code®	The QR Code® refers to the SMA bonus programme (for information on this, see www.SMA-Bonus.com).

4.2 Type Label

The type label uniquely identifies the inverter. The type label is located on the right-hand side of the enclosure. To the right of the type label, there is an additional sticker with information on the registration in Sunny Portal.

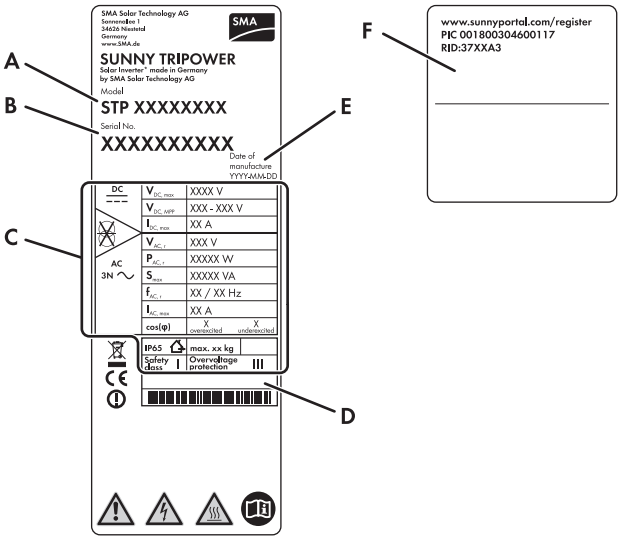


Figure 4: Design of the type label and the additional sticker

Position	Description	Explanation
A	Model	Inverter device type
B	Serial No.	Inverter serial number
C	Device-specific characteristics	–
D	Additional information	Field for additional information, e.g. country-specific standard information
E	Date of manufacture	Inverter manufacture date (year-month-day)
F	Additional sticker	Internet address, identification key (PIC) and registration ID (RID) for registration in the Sunny Portal

You require the information on the type label to use the inverter safely and for customer support at the SMA Service Line. The type label must be permanently attached to the inverter.

Symbols on the Type Label

Symbol	Description	Explanation
	Danger to life due to high voltages	The product operates at high voltages. All work on the inverter must be carried out by skilled persons only.
	Risk of burns from hot surfaces	The product can become hot during operation. Avoid contact during operation. Allow the product to cool down sufficiently before carrying out any work. Wear personal protective equipment such as safety gloves.
	Observe the documentation	Observe all documentation that is supplied with the product.
	Danger	If a second protective conductor is required, also earth the enclosure (see Section 6.3.3).
DC	DC	Direct current
	Without transformer	The product does not have a transformer.
AC 3N	AC	Three-phase alternating current with neutral conductor
	WEEE designation	Do not dispose of the product together with the household waste but in accordance with the locally applicable disposal regulations for electronic waste.
CE	CE marking	The product complies with the requirements of the applicable EC directives.
	Device class ID	The product is equipped with a wireless component and complies with device class 2.
IP65	Degree of protection	The product is protected against dust intrusion and water jets from any angle.

Symbol	Description	Explanation
	Outdoor	The product is suitable for outdoor installation.
	RAL quality mark for solar products	The product complies with the requirements of the German Institute for Quality Assurance and Certification.
	Certified safety	The product is VDE-tested and complies with the requirements of the German Equipment and Product Safety Act.
	C-Tick	The product complies with the requirements of the applicable Australian EMC standards.

4.3 Electronic Solar Switch (ESS)

The ESS and the DC connectors form a DC load disconnect unit. A *Bluetooth* antenna, integrated into the ESS, increases the radio range.

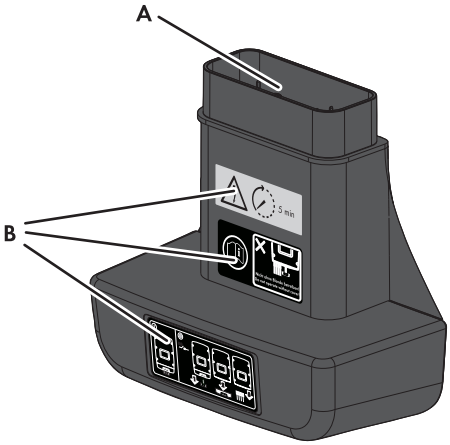
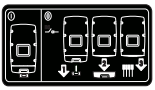


Figure 5: Design of the ESS

Position	Description	Explanation
A	Plug	The plug and the *Bluetooth* antenna are inside the enclosure.
B	Stickers	–

When plugged in, the ESS forms a conductive path between the PV array and the inverter. Removing the ESS will interrupt the DC electric circuit and removing all DC connectors will disconnect the PV array completely from the inverter.

ESS Stickers

Sticker	Description	Explanation
	Functionality with ESS plugged in and removed	• I If the ESS is plugged in, the DC electric circuit is closed. • O To interrupt the DC electric circuit, you must perform the following steps in order: • 1 Remove the ESS. • 2 Remove the protective cover. • 3 Release and disconnect all DC connectors.
	Danger to life due to high voltages in the inverter; observe waiting time.	High voltages that can cause fatal electric shocks are present in the live components of the inverter. Disconnect the inverter from any voltage sources before performing any work on it (see Section 10).
	Using the inverter without a protective cover is prohibited	Always operate the inverter with a protective cover.

4.4 Display

The display shows the current operating data of the inverter (e.g. current power, daily energy, total energy) as well as events or errors. The power and energy are displayed as bars in the diagram.

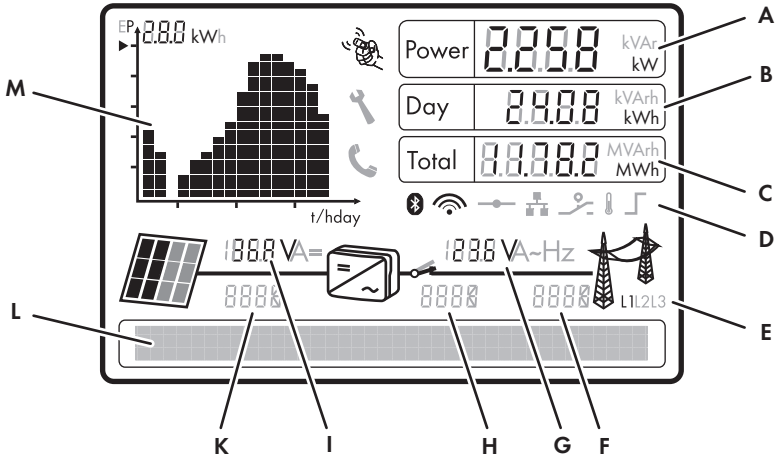


Figure 6: Display design (example)

Position	Description	Explanation
A	Power	Current power
B	Day	Daily energy
C	Total	Total amount of energy fed in until now
D	Active functions	The different symbols indicate which functions for communication, grid management or temperature derating are enabled or active.
E	Line conductor	Indicates which line conductor the displayed values are assigned to
F	Event number relating to the electricity grid	Event number of errors relating to the electricity grid
G	Output voltage/ output current	Displays output voltage and output current of a line conductor in alternation
H	Event number relating to the inverter	Event number of errors relating to the inverter
I	Input voltage/ input current	Displays input voltage and input current of one input in alternation

Position	Description	Explanation
K	Event number relating to the PV array	Event number of errors relating to the PV array
L	Text line	Displays the event message or error message
M	Power and yield curve	Changes in power over the last 16 feed-in hours or the energy yields over the last 16 days • In order to switch between the displays, tap once on the enclosure lid.

Symbols on the Display

Symbol	Description	Explanation
	Tapping	You can operate the display by tapping on the enclosure lid: • Tapping once: to activate the backlight, to scroll to the next text line, to switch between the power graphs of the last 16 feed-in hours and the energy yields of the last 16 days • Tapping twice: the display alternates automatically between the firmware version, the serial number of the inverter, the NetID, IP address, subnet mask, the configured country data set and display language.
	Telephone receiver	Indicates that an error cannot be rectified on site • Contact the SMA Service Line.
	Spanner	Indicates that an error can be rectified on site
	Bluetooth	Indicates that an active *Bluetooth* connection is established
	Bluetooth connection quality	Indicates the quality of the *Bluetooth* connection to other *Bluetooth* devices
	Speedwire	Indicates that there is a connection to a network
	Webconnect function	Indicates that connection to Sunny Portal is possible

Symbol	Description	Explanation
	Multi-function relay	Indicates that the multi-function relay is active
	Thermometer	Indicates that the power of the inverter is limited due to excessive temperature
	Power limitation	Indicates that the external active power limitation via the Power Reducer Box is active
	PV array	–
	Inverter	–
	Grid relay	A closed grid relay indicates that the inverter is feeding into the electricity grid. An open grid relay shows that the inverter is disconnected from the electricity grid.
	Electricity grid	–

4.5 Communication

The inverter is equipped with *Bluetooth* communication as standard. Additionally, it features Speedwire communication with Webconnect function.

The inverter can communicate with special SMA communication products and other inverters via *Bluetooth* (see Section 7.4 "Setting the NetID", page 57).

If you would like to communicate via *Bluetooth*, you can protect the inverter with a plant password for the user and a plant password for the installer.

All inverters are delivered with a standard plant password for the user (0000) and a standard plant password for the installer (1111). To protect the plant from unauthorised access, you must change the plant passwords using Sunny Explorer (for information on changing the plant password, refer to the Sunny Explorer help).

If you do not want to communicate via *Bluetooth*, deactivate the *Bluetooth* communication (see Section 7.4 "Setting the NetID", page 57).

You can connect the inverter to your network via Speedwire. If you use the Webconnect function and have registered your plant in Sunny Portal, Sunny Portal can call up the latest data from your inverter (for information on the logging of your plants in Sunny Portal, refer to the Sunny Portal user manual at www. SMA-Solar.com).

You can adjust the country data set of the inverter before commissioning or within the first ten operating hours via the two rotary switches in the inverter. You can set all other operating parameters of the inverter via the communication products only (for information on how to change the parameters, see documentation for the communication product).

4.6 Multi-Function Relay

You can use the multi-function relay for various purposes:

Application (operating mode) of the multi-function relay	Description
Fault indication	The multi-function relay controls a display device which, depending on the type of connection, either reports an error or the undisturbed operation of the inverter.
Self-consumption	The multi-function relay switches the loads on or off depending on the power range of the PV plant.
Control via communication	The multi-function relay switches the loads on and off via a communication product.
Battery bank	The multi-function relay controls the charging of the batteries depending on the power range of the PV plant.
Fan control	The multi-function relay controls an external fan depending on the temperature of the inverter.
Switching status grid relay	The local network operator may require that a signal is transmitted as soon as the inverter connects to the electricity grid. The multi-function relay simulates the switching status of the grid relay and trips a signal to the network operator.

There is a different connection procedure depending on how you intend to use the multi-function relay (see Section 6.6.1 "Connection Options for the Multi-Function Relay", page 46).

The operating mode of the multi-function relay has been set by default to **Fault indication**. If you have chosen another operating mode, you need to change the operating mode via a communication product after commissioning and possibly also other settings (see Section 9.5 "Changing the Operating Mode of the Multi-Function Relay", page 64).

4.7 Slot for the Power Control Board

The inverter has a slot for the Power Control Board. The Power Control Board can be retrofitted or installed at the factory, if a respective order is placed.

The Power Control Board enables the inverter to perform grid management functions (you will find installation and configuration instructions in the installation manual of the Power Control Board).

4.8 Grid Management

The inverter is equipped with grid management functions.

Depending on the requirements of the network operator, you can activate and configure the functions (e.g. provision of reactive power, active power limitation) via operating parameters (for information on the functions and operating parameters, see the Technical Description "Measured Values and Parameters" at www.SMA-Solar.com).

4.9 SMA OptiTrac Global Peak

SMA OptiTrac Global Peak is a more advanced form of the SMA OptiTrac MPP tracking.

MPP tracking is a feature that determines the highest usable power in the PV plant at any given time. The power generated by the PV array depends on the level of solar irradiation and the temperature of the PV modules. As a result, the optimal operating point for the maximum power (MPP) changes constantly throughout the day.

SMA OptiTrac ensures that the operating point of the inverter always coincides exactly with the MPP. Moreover, the inverter detects the presence of several maximum power points in the available operating range via SMA OptiTrac Global Peak, as they can occur with partially shaded PV strings. Thus, the full power of the partially shaded PV strings can be almost completely fed into the electricity grid.

SMA OptiTrac Global Peak is deactivated by default. With partially shaded PV modules, it should be activated and set via a communication product (see Section 9.6).

4.10 Varistors

Varistors are voltage-dependent resistors that protect the inverter against overvoltage. The inverter is equipped with thermally monitored varistors.

Varistors can become worn and lose their protective function with age or repeated strain as a result of overvoltage. The inverter detects if one of the varistors is defective and indicates an error.

The varistors are specially manufactured for use in the inverter and are not commercially available. You must order new varistors directly from SMA Solar Technology AG.

4.11 SMA Grid Guard

SMA Grid Guard acts as an automatic disconnection device between a grid-parallel generator (e.g. a PV plant) and the electricity grid.

Furthermore, SMA Grid Guard is a grid monitoring concept, which prevents errors by permanently monitoring grid impedance, line voltage and power frequency. For example, SMA Grid Guard detects when a stand-alone grid is formed and disconnects the inverter from the electricity grid immediately.

In some countries, the connection conditions require a device which protects grid-relevant operating parameters against unpermitted changes. SMA Grid Guard performs this function.

Some country data sets are automatically protected after the first ten feed-in hours. The protected country data sets can only be changed via a communication product and after you enter a personal access code, the SMA Grid Guard code, after the ten feed-in hours. You will receive the SMA Grid Guard code from SMA Solar Technology AG.

5 Mounting

5.1 Selecting the Mounting Location

Requirements for the mounting location:

⚠ WARNING

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fires.

- Do not mount the inverter on flammable construction materials.
- Do not mount the inverter in areas where highly flammable materials are stored.
- Do not mount the inverter in a potentially explosive atmosphere.

☐ The mounting location must be inaccessible to children.

☐ A solid foundation must be available for mounting, e.g. concrete or masonry. In a living area, make sure that the foundation is not made of plasterboard or similar. The inverter makes noises when in use, which can be a disturbance in a living area.

☐ The mounting location must be suitable for the weight and dimensions of the inverter (see Section 13 "Technical Data", page 90).

☐ The mounting location must be freely and safely accessible at all times without the necessity for any auxiliary equipment, such as scaffolding or lifting platforms. Non-fulfillment of these criteria may restrict execution of servicing.

☐ The installation site must not be exposed to direct solar irradiation. Direct solar irradiation can heat up the inverter excessively. As a result, the inverter reduces its power output.

☐ Climatic conditions must be met (see Section 13 "Technical Data", page 90).

☐ The ambient temperature must be below 40°C to ensure the optimal operation of the inverter.

Dimensions for wall mounting:

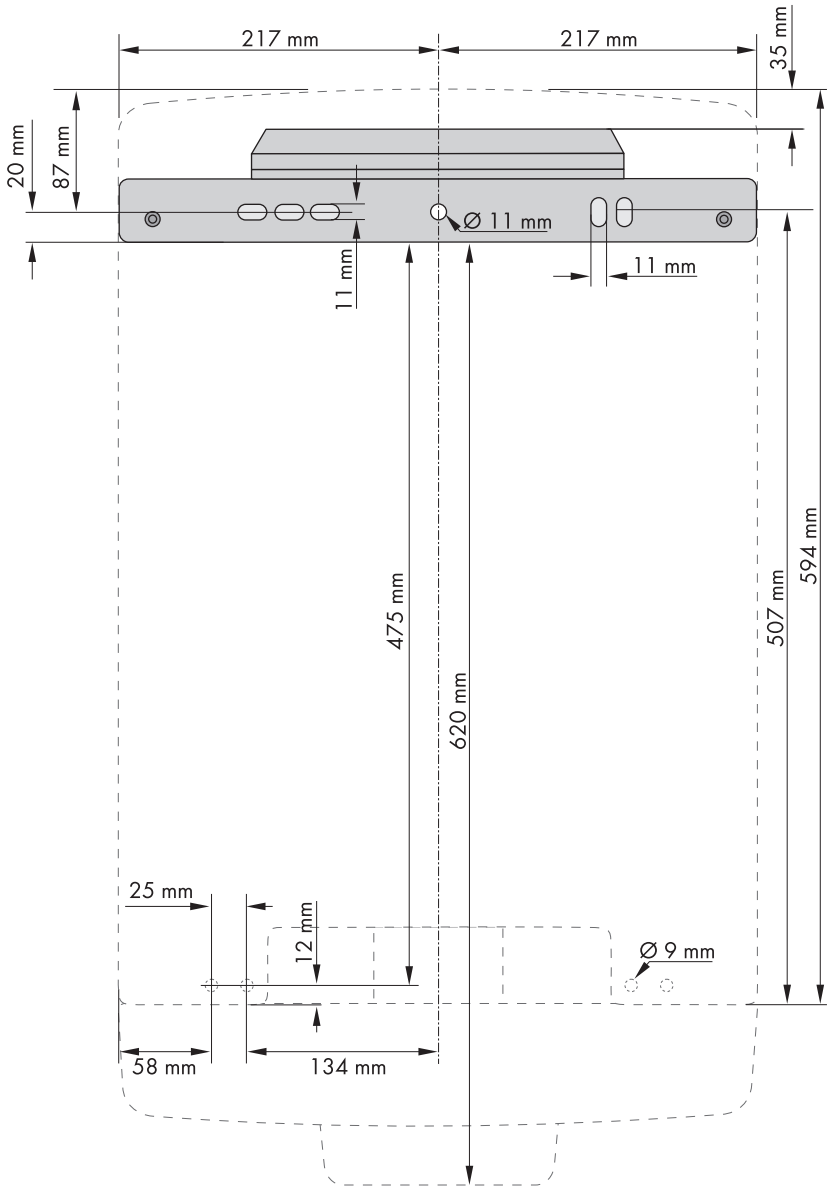


Figure 7: Dimensions of the wall mounting bracket and dimensions of the drill holes in the inverter enclosure for the optional anti-theft device

Observe recommended clearances:

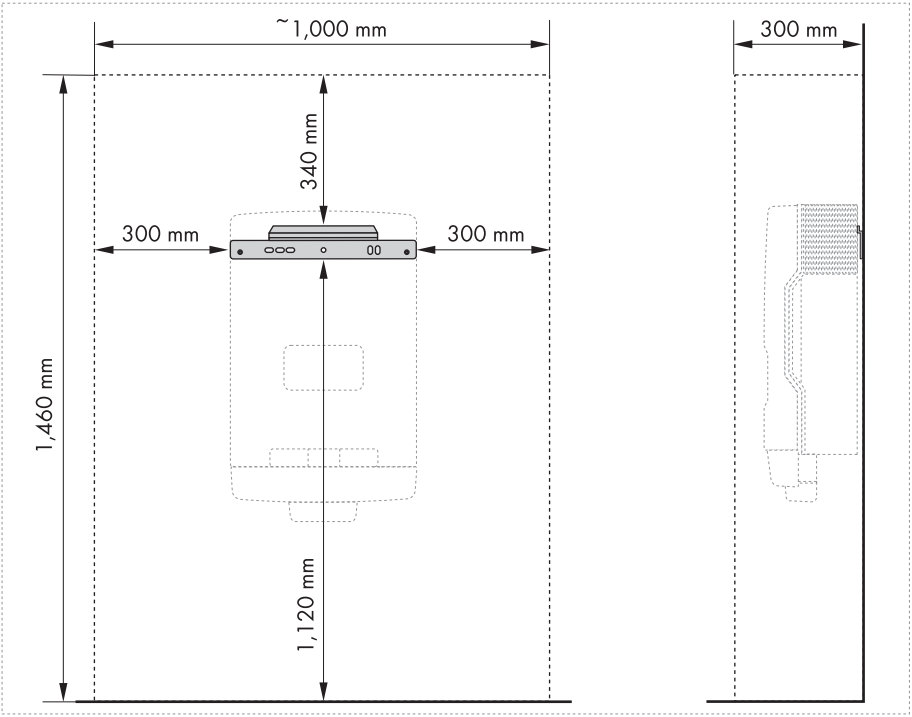


Figure 8: Recommended clearances

- Observe the recommended clearances to the walls as well as to other inverters or objects. This ensures adequate heat dissipation and sufficient space to remove the ESS.
- If multiple inverters are mounted in areas with high ambient temperatures, increase the clearances between the inverters and ensure an adequate fresh-air supply.

☑ This prevents a reduction in inverter power as a result of high temperatures (details on temperature derating can be found in the Technical Information "Temperature Derating" at www.SMA-Solar.com).

Observe permitted mounting position:

Figure 9: Permitted and prohibited mounting positions

- Mount the inverter in a permitted mounting position. The display must be mounted at eye level.
  - ☑ Mounting the inverter in a permissible position will ensure that no moisture can penetrate it.
  - ☑ By mounting the device at eye level, display messages and LED signals can be read without difficulty.

5.2 Mounting the Inverter

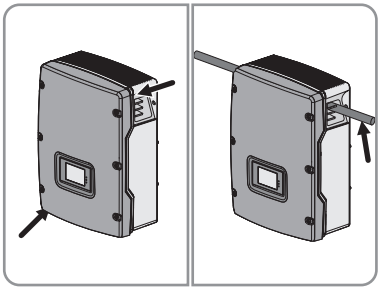
Additionally required mounting material (not included in the scope of delivery):

- ☐ At least two screws that are suitable for the foundation
- ☐ At least two washers that are suitable for the screws
- ☐ At least two wall plugs that are suitable for the foundation and for the screws
- ☐ At least one safety screw if the inverter is to be secured against theft

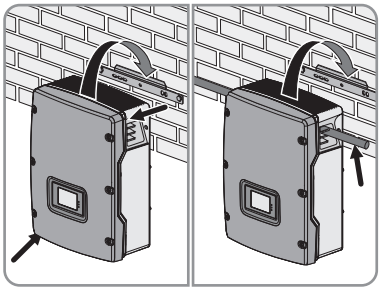
⚠ CAUTION

Risk of injury due to the heavy weight of the inverter

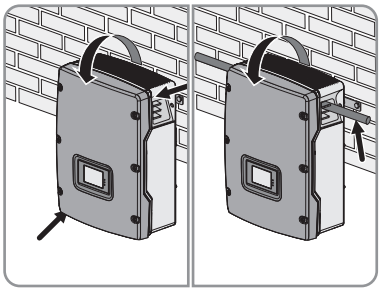
- Take the weight of the inverter into account (see Section 13 "Technical Data", page 90).
- Transport the inverter horizontally using the recessed grips on the sides or one steel rod (diameter: 30 mm at maximum).



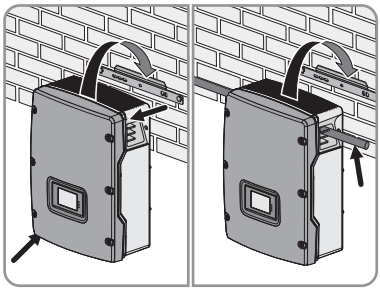
1. Ensure that there are no lines laid in the wall which could be damaged when drilling.
2. Mark the position of the drill holes using the wall mounting bracket. Use at least one hole on the left-hand side and right-hand side in the wall mounting bracket.
3. Drill the holes and insert the wall plugs.
4. Secure the wall mounting bracket horizontally to the wall using screws and washers.
5. If the inverter is to be protected against theft, mark the drill holes:
   - Hang the inverter in the wall mounting bracket.



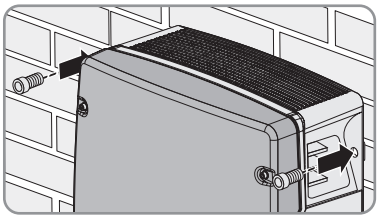
   - Mark the drill hole. Use at least one hole on the left-hand side or right-hand side in the bottom of the enclosure.
   - Remove the inverter by lifting it up and out of the wall mounting bracket.



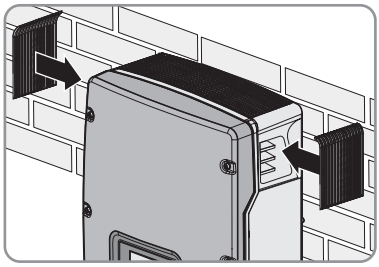
   - Drill the hole and insert the wall plug.
6. Hang the inverter in the wall mounting bracket.



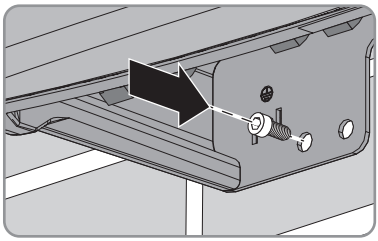
7. Attach the inverter to the wall mounting bracket on both sides using the M6x8 screws provided and an Allen key (AF 5). For this purpose, tighten the screws by hand. That prevents the inverter being lifted out.



8. Close the recessed grips with the ventilation grids. Ensure that the assignment is correct. Each ventilation grid is assigned to an enclosure side on the inside: **links/left** for the left-hand side and **rechts/right** for the right-hand side.



9. In order to protect the inverter against theft, fasten the bottom of the inverter to the wall on the left-hand side or right-hand side using at least one safety screw.



10. Ensure that the inverter is securely attached.

6 Electrical Connection

6.1 Safety during Electrical Connection

Electric Shock

High voltages that can cause fatal electric shocks are present in the live components of the inverter.

- Prior to performing any work on the inverter, disconnect it from any voltage source as described in this document (see Section 10).

Electrostatic Discharge

Touching electronic components can cause damage to or destroy the inverter through electrostatic discharge.

- Earth yourself before touching any components.

6.2 Overview of the Connection Area

6.2.1 View from Below

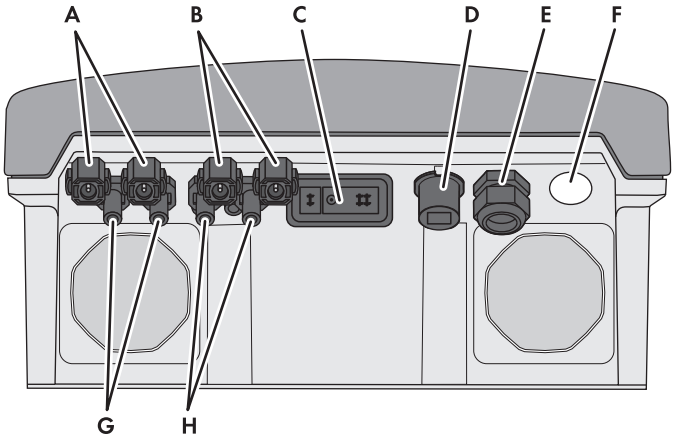


Figure 10: Connection areas and enclosure openings at the bottom of the inverter

Position	Description
A	Positive DC connectors for connecting the positive DC cables of the PV modules for input A
B	Positive DC connectors for connecting the positive DC cables of the PV modules for input B
C	Socket for connecting the ESS
D	Socket with filler-plug for the network terminal
E	M25 cable gland with filler-plug for connecting the multi-function relay or Power Control Board
F	Enclosure opening for the AC cable
G	Negative DC connectors for connecting the negative DC cables of the PV modules for input A
H	Negative DC connectors for connecting the negative DC cables of the PV modules for input B

6.2.2 Interior View

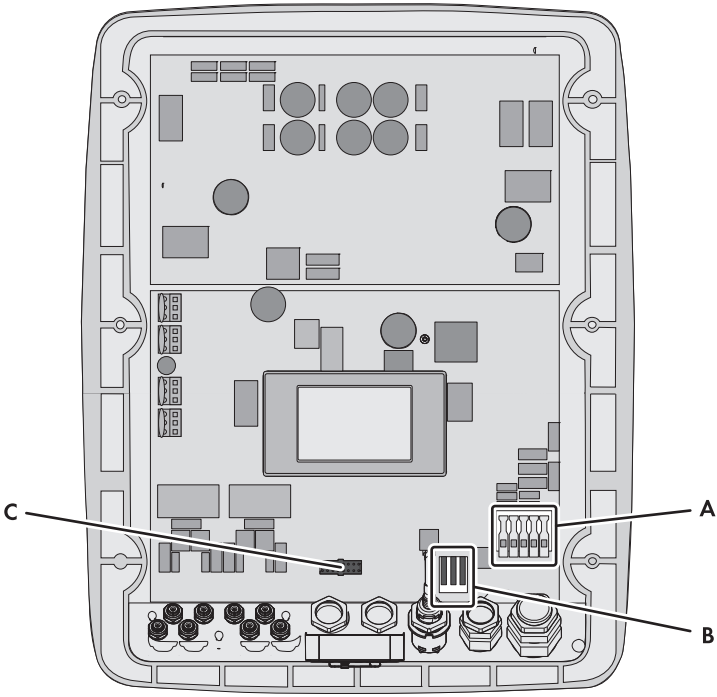


Figure 11: Connection areas in the interior of the inverter

Position	Description
A	Connecting terminal plate for the AC cable
B	Terminal for connection to the multi-function relay
C	Slot for the Power Control Board

6.3 AC Connection

6.3.1 Conditions for the AC Connection

Cable requirements:

- ☐ External diameter of the cable must correspond to the clamping range of the cable gland: 12 mm ... 21 mm
- ☐ Recommended conductor cross-section for stiff or flexible cables, with or without bootlace ferrule: 1.5 mm² ... 6 mm²
- ☐ Conductor cross-section: 10 mm² at maximum
- ☐ Stripping length: 15 mm
- ☐ The cable must be dimensioned in accordance with the local and national directives for the dimensioning of cables. The requirements for the minimum conductor cross-section derive from these directives. Influencing factors for cable dimensioning are, among others, the following: nominal AC current, type of cable, routing method, cable bundling, ambient temperature and maximum desired line losses (for calculation of line losses, see design software "Sunny Design" with software version 2.0 or higher at www.SMA-Solar.com).

Switch-disconnector and cable protection:

NOTICE

Damage to the inverter by using screw-type fuses as switch-disconnectors

Screw-type fuses (e.g. DIAZED fuses or NEOZED fuses) are not switch-disconnectors.

- Do not use screw-type fuses as switch-disconnectors.
- Use a switch-disconnector or miniature circuit-breaker as a load disconnection unit (for information and examples for designing, see the Technical Information "Miniature Circuit-breaker" at www.SMA-Solar.com).

- In plants with multiple inverters, protect every inverter with a separate three-phase miniature circuit-breaker. Observe the maximum permissible fuse protection (see Section 13 "Technical Data", page 90). That prevents residual voltage being present at the corresponding cable after disconnection.
- Loads installed between the inverter and the miniature circuit-breaker must be protected separately.

Residual-current monitoring unit:

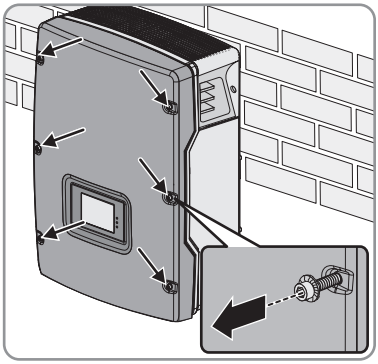
- If an external residual-current device is prescribed, install a residual-current device that trips at a residual current of 100 mA or higher (for information on the selection of residual-current devices, see the Technical Information "Criteria for Selecting a Residual-Current Device" at www.SMA-Solar.com).

6.3.2 Connecting the Inverter to the Electricity Grid

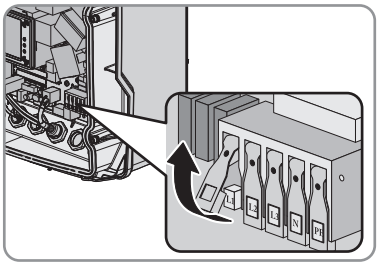
Requirements:

- ☐ The country data set and the display language must be correctly set (see Section 7.2)
- ☐ The connection requirements of the network operator must be met.
- ☐ The line voltage must be in the permissible range. The exact operating range of the inverter is specified in the operating parameters (see the Technical Description "Measured Values and Parameters" at www.SMA-Solar.com).

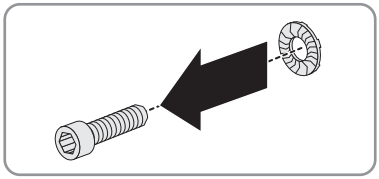
1. Disconnect the miniature circuit-breaker and secure against reconnection.
2. Loosen the screws and conical spring washers of the enclosure lid using an Allen key (AF 5) and remove the lid.



3. Remove the adhesive tape from the enclosure opening for the AC cable.
4. Attach the M32x1.5 cable gland to the enclosure opening for the AC cable using a counter nut.
5. Strip the AC cable insulation.
6. Shorten L1, L2, L3 and N by 5 mm each.
7. Strip 18 mm of the L1, L2, L3, N and PE insulation each.
8. Route the AC cable into the inverter through the cable gland. If necessary, slightly loosen the swivel nut of the cable gland.
9. Push the safety levers of the AC connecting terminal plate right up to the stop.

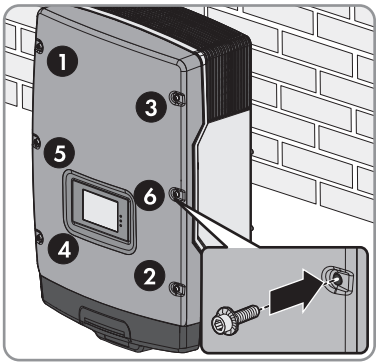


10. Connect the AC cable to the connecting terminal plate for the AC cable:
    - Connect PE to the **PE** terminal and push the safety lever down.
    - Connect N to the **N** terminal and push the safety lever down.
    - Connect L1 to the **L1** terminal and push the safety lever down.
    - Connect L2 to the **L2** terminal and push the safety lever down.
    - Connect L3 to the **L3** terminal and push the safety lever down.
11. Tighten the swivel nut of the cable gland.
12. Close the inverter and earth the enclosure lid:
    - Attach one conical spring washer on each screw. The grooved side of the conical spring washer must point to the screw head.



    - Secure the enclosure lid in the sequence 1 to 6 (torque: 6 Nm) using an Allen key (AF 5).

    ☑ The teeth of the conical spring washers are pushed into the enclosure lid. This earths the enclosure lid.



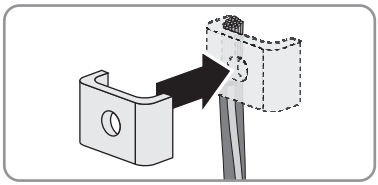
6.3.3 Additional Earthing of the Enclosure

If a second protective conductor or equipotential bonding is required locally, you can also earth the enclosure. This prevents touch current if the original protective conductor fails.

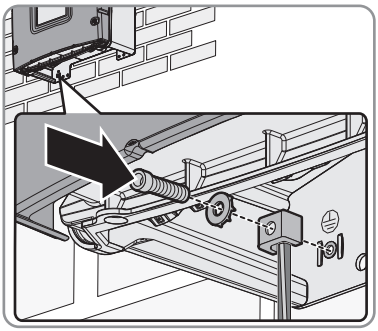
Cable requirement:

☐ Earthing cable cross-section: 16 mm² at maximum

1. Strip the earthing cable insulation.
2. Route the clamping bracket via the stranded wire. Arrange the stranded wire on the left-hand side.



3. Secure the clamping bracket using the M6x16 cheese-head screw and a conical spring washer. The teeth of the conical spring washer must face the clamping bracket.



6.4 DC Connection

6.4.1 Conditions for DC Connection

Requirements for the PV modules per input:

- ☐ All PV modules must be of the same type.
- ☐ All PV modules must be aligned identically.
- ☐ All PV modules must have the same tilt angle.
- ☐ The maximum input current per string must be maintained and must not exceed the through-fault current of the DC connectors (see Section 13 "Technical Data", page 90).
- ☐ The limiting values for the input voltage and the input current of the inverter must be maintained (see Section 13 "Technical Data", page 90).
- ☐ At an ambient temperature over 10°C, the open-circuit voltage of the PV modules must not exceed 90% of the maximum input voltage of the inverter. That prevents the voltage exceeding the maximum input voltage of the inverter at lower ambient temperatures.
- ☐ The positive connection cables of the PV modules must be equipped with the positive DC connectors.
- ☐ The negative connection cables of the PV modules must be equipped with the negative DC connectors.

Use of Y Adaptors for Parallel Connection of Strings

The Y adaptors must not be used to interrupt the DC electric circuit.

- Do not use the Y adaptors in close proximity of the inverter. The adaptors may not be visible or freely accessible.
- Disconnect the inverter from voltage sources only as described in this document (see Section 10).

6.4.2 Assembling the DC Connectors

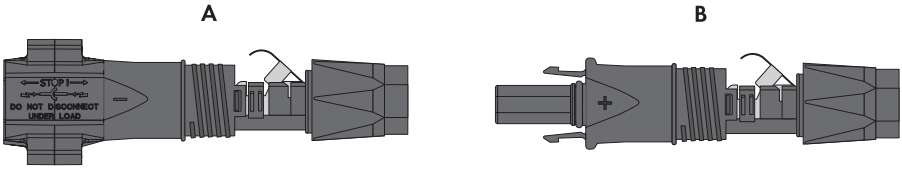


Figure 12: DC connectors

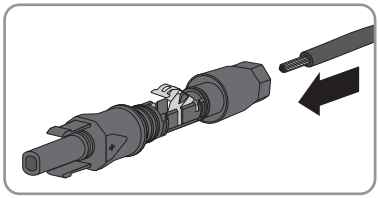
Position	Description
A	Negative DC connector
B	Positive DC connector

Cable requirements:

- ☐ PV1-F cable must be available.
- ☐ External diameter of the cable: 5 mm ... 8 mm
- ☐ Conductor cross-section: 2.5 mm² ... 6 mm²

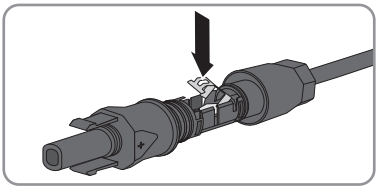
Proceed as follows to assemble each DC connector.

1. Strip 12 mm of the cable insulation.
2. Lead the stripped cable all the way into the DC connector. Ensure that the stripped cable and the DC connector have the same polarity.

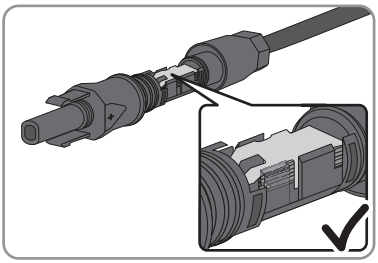


3. Push the clamping bracket down.

   ☑ The clamping bracket clicks audibly into place.



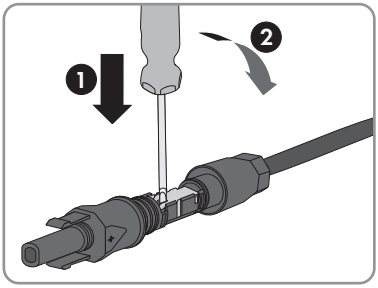
   ☑ The stranded wire can be seen inside the clamping bracket chamber.



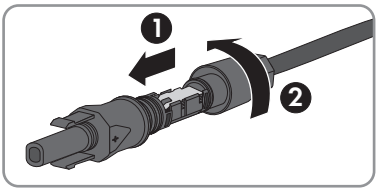
   ✖ The stranded wire cannot be seen in the chamber.

   The cable is not correctly in place.

   - Release the clamping bracket. To do so, insert a screwdriver (blade width: 3.5 mm) into the clamping bracket and lever it out.
   - Remove the cable and go back to step 2.



4. Push the swivel nut up to the thread and tighten (torque: 2 Nm).



6.4.3 Connecting the PV Array

⚠ WARNING

Danger to life due to electric shock or fire

The maximum possible input current per string is limited by the DC connectors used. If the DC connectors are overloaded, an electric arc may occur and there is a risk of fire.

- Ensure that the maximum input current per string does not exceed the maximum through-fault current of the DC connectors used (see Section13 "Technical Data", page 90).

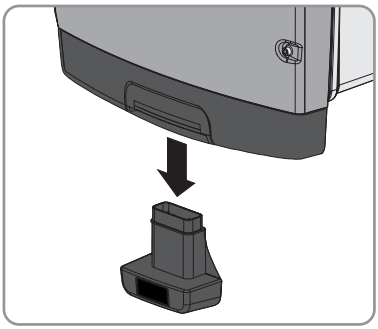
NOTICE

Destruction of the inverter due to overvoltage

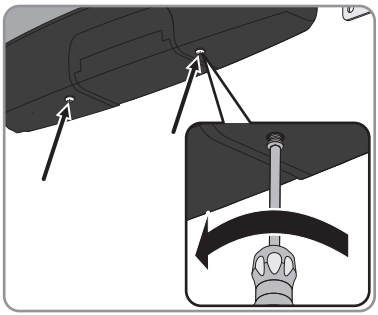
If the open-circuit voltage of the PV modules exceeds the maximum input voltage of the inverter, the inverter can be destroyed by the overvoltage.

- If the open-circuit voltage of the PV modules exceeds the maximum input voltage of the inverter, do not connect any strings to the inverter and check the design of the PV plant.

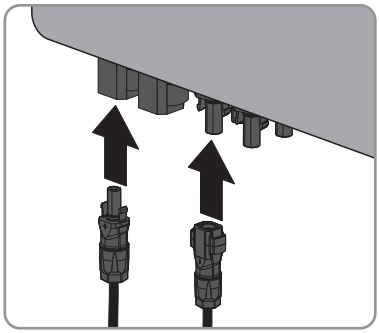
1. Disconnect the miniature circuit-breaker and secure against reconnection.
2. If the ESS is plugged in, remove the ESS.



3. If the protective cover is mounted, loosen the two screws of the protective cover using an Allen key (AF 5) and remove the protective cover.



4. Check strings for earth faults (see Section 11.5).
5. Connect the assembled DC connectors to the inverter.
   ☑ The DC connectors click audibly into place.

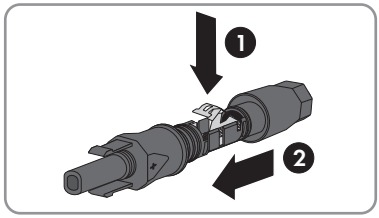


6. **NOTICE**

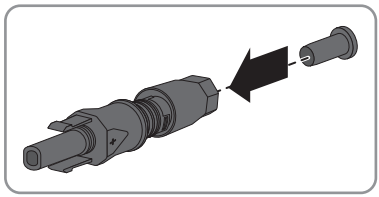
Damage to the inverter due to moisture penetration

The inverter is only properly sealed when all the unused DC inputs are closed with DC connectors and sealing plugs.

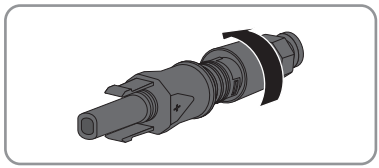
- **DO NOT** insert the sealing plugs **DIRECTLY** into the DC inputs on the inverter.
- For unused DC connectors, push down the clamping bracket and push the swivel nut up to the thread.



- Insert the sealing plug into the DC connector.

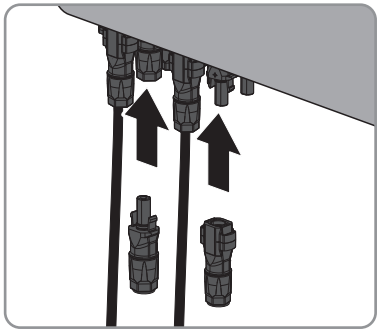


- Tighten the DC connector (torque: 2 Nm).



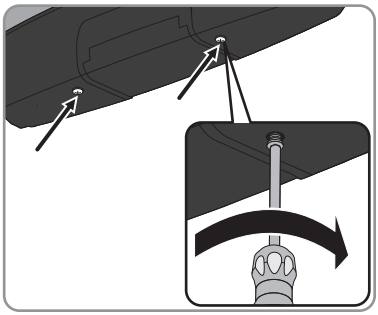
- Insert the DC connectors with sealing plugs into the corresponding DC inputs on the inverter.

  ☑ The DC connectors click audibly into place.

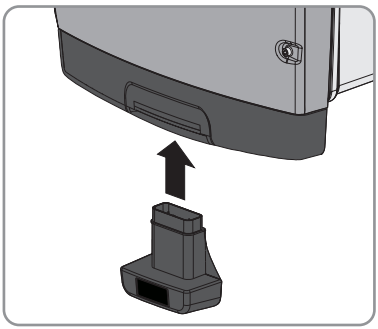


7. Ensure that all DC connectors are securely in place.

8. Secure the protective cover using two screws and an Allen key (AF 5).



9. Securely plug in the ESS.

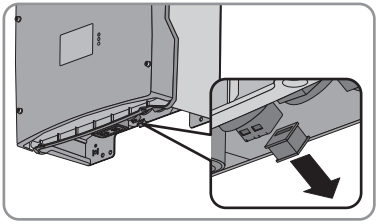


6.5 Connecting the Inverter to the Network

Required material (not included in the scope of delivery):

- 1 plug for RJ45 socket according to IEC 61076-3-106, model 4 with push-pull lock
  Recommendations:
  - "STX V4 RJ45" plug set; manufacturer: Telegärtner
  - "IE-PS-V04P-RJ45-FH" plug set; manufacturer: Weidmüller
- 1 network cable with the following properties:
  - Type of cable: 100BaseTx, CAT5 with S-FTP or S-STP shielding
  - Cross-section: at least 2x2x0.22 mm² or at least 2x2 AWG 24
  - Maximum cable length: 100 m
  - UV-resistant for outdoor use

1. Connect one end of the network cable to the plug (see documentation of plug).
2. Remove the filler-plug from the socket for connecting the inverter to the network.



3. Connect the end of the network cable with the plug to the inverter. To do this, insert the plug firmly into the socket on the inverter.
4. Connect the other end of the network cable to the network or to one of the other nodes.
   Hint: You can only connect the inverter to the other nodes via star topology.

6.6 Connecting the Multi-Function Relay

6.6.1 Connection Options for the Multi-Function Relay

You can choose between three connection options:

- Using the multi-function relay as fault or operation signalling contact
- Controlling loads or charging batteries via the multi-function relay
- Reporting switching status of grid relay

Using the Multi-Function Relay as Fault Signalling Contact

You can make use of the multi-function relay as a fault signalling contact and have an error of the inverter either displayed or reported. Alternatively, you can choose to have uninterrupted operation displayed or reported. It is possible to connect several inverters to one fault or operation indicator. To enable this function, the multi-function relays of several inverters must be switched in parallel.

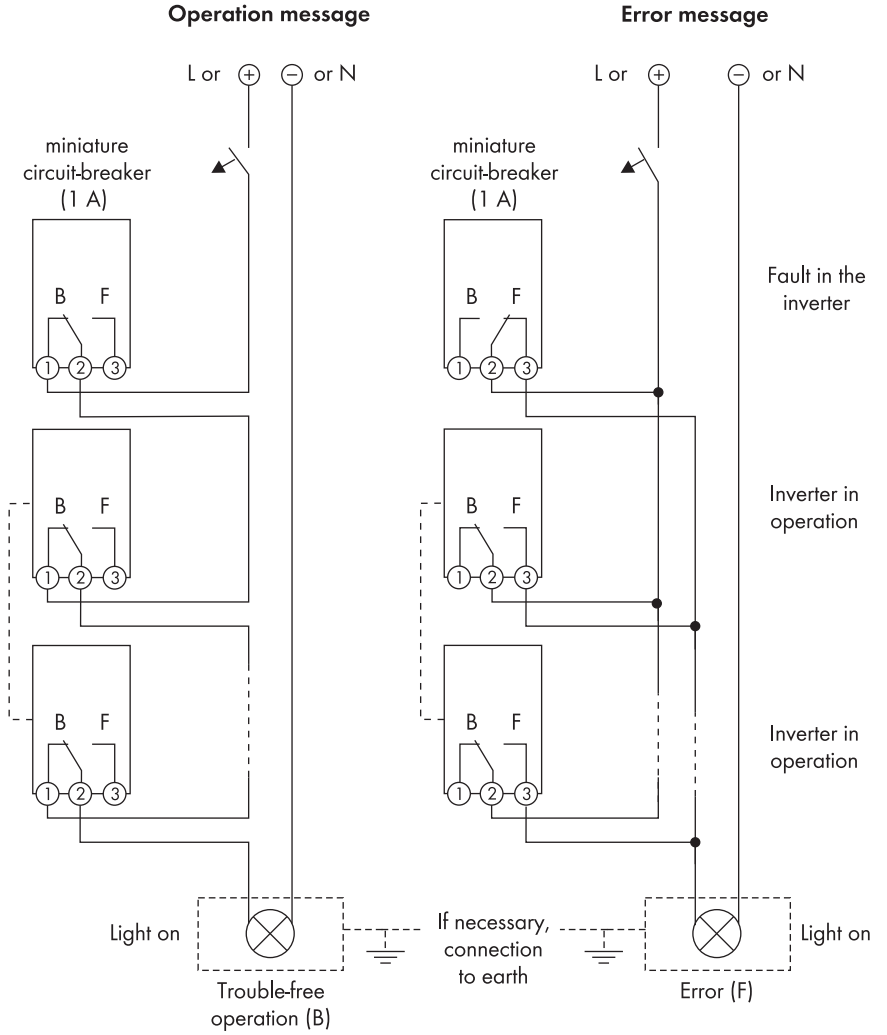


Figure 13: Wiring diagram for connection of operation indicator and fault indicator

Controlling Loads or Charging Batteries in a Power-Dependent Way via the Multi-Function Relay

Loads can be controlled and batteries charged in a power-dependent way via the multi-function relay. To enable this function, you need to connect a contactor (K1) to the multi-function relay. The contactor (K1) switches the operating current for the load on or off. If you want batteries to be charged depending on the available power, the contactor serves to activate or deactivate the charging of the batteries.

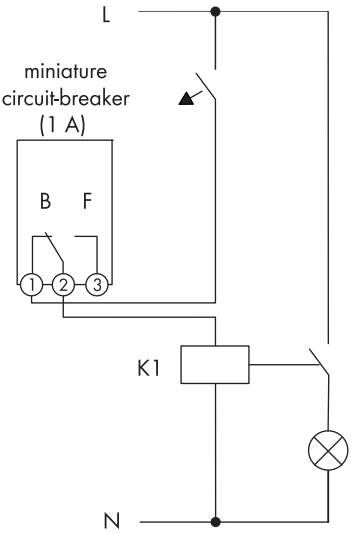


Figure 14: Wiring diagram for connection to control a load or for the power-dependent charging of the batteries

Reporting Switching Status of Grid Relay

The multi-function relay can trip a signal to the network operator as soon as the inverter connects to the electricity grid. To enable this function, the multi-function relays of all inverters must be switched in parallel.

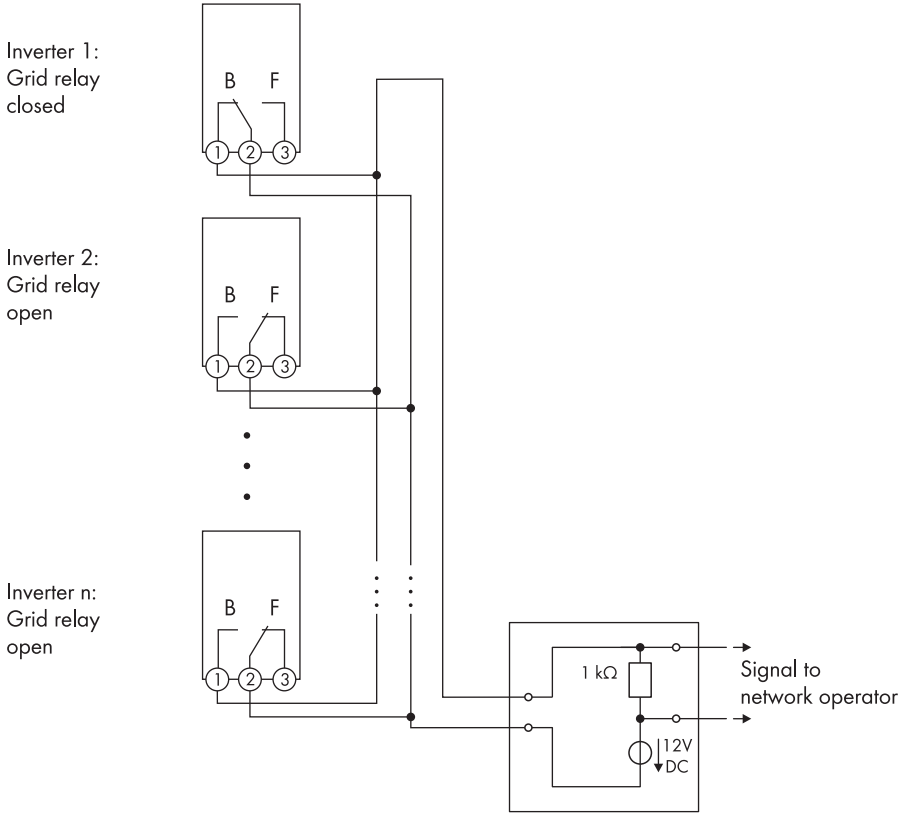


Figure 15: Wiring diagram for reporting the switching status of the grid relay (example)

6.6.2 Connection to the Multi-Function Relay

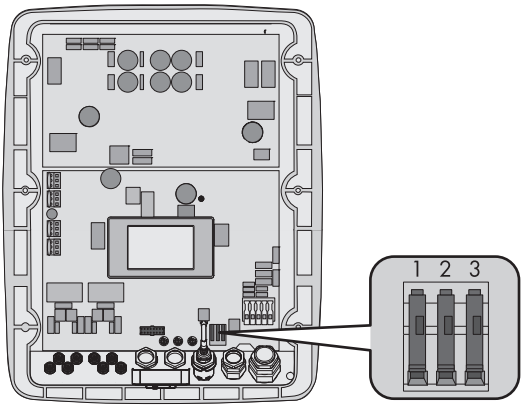


Figure 16: Terminal block for connection to the multi-function relay

Requirements:

☐ The technical requirements of the multi-function relay must be met (see Section 13 "Technical Data", page 90).

Cable requirements:

☐ The cable is double-insulated.

☐ External diameter: 5 mm ... 12 mm

☐ Conductor cross-section: 0.08 mm² ... 2.5 mm²

☐ The cable type and cable-laying method must be appropriate to the application and location.

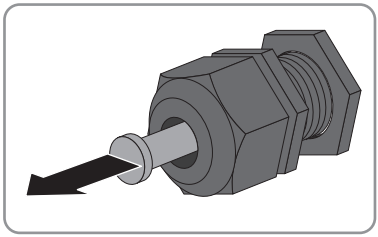
NOTICE

Destruction of the multi-function relay as a result of excessive contact load

- Adhere to maximum switching voltage and maximum switching current (see Section 13.9 "Multi-Function Relay", page 102).
- When connecting the multi-function relay to the electricity grid, protect the multi-function relay with an individual miniature circuit-breaker.

1. When connecting to the electricity grid, protect the multi-function relay with an individual miniature circuit-breaker.
2. Disconnect the inverter from voltage sources (see Section 10).

3. Remove the filler-plug from the M25 cable gland for connection to the multi-function relay.



4. Route the cable into the inverter through the cable gland. If necessary, slightly loosen the swivel nut of the M25 cable gland for connection to the multi-function relay.
5. Strip 15 mm of the cable insulation at maximum.
6. Strip 8 mm of the conductor insulation at maximum.
7. Depending on the intended use (operating mode), connect the cable to the terminal plate for connection to the multi-function relay in accordance with the wiring diagram.
8. Tighten the swivel nut of the cable gland.
9. Commission the inverter (see Section 8).

7 Settings using the Rotary Switches

7.1 Overview of the Rotary Switches

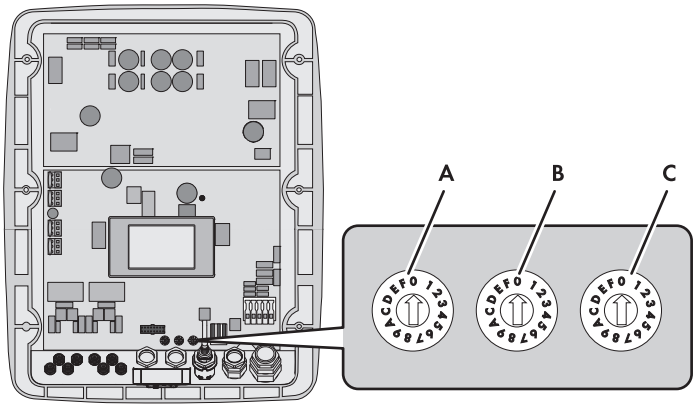


Figure 17: Configuration area inside the inverter

Position	Description
A	Rotary switch A for the country data set
B	Rotary switch B for the display language
C	Rotary switch C for NetID

Possible Settings of the Rotary Switches A and B

In the following, you will find a list of possible rotary switch positions and which country data sets and display languages are indicated by each position (for information on the country data sets, see the technical description "Overview of Country Data Sets" at www.SMA-Solar.com).

Each country data set contains various operating parameters, which can be individually set according to each country data set. You can read out the operating parameters via a communication product (for information on the operating parameters and country data sets, see the Technical Description "Measured Values and Parameters" at www.SMA-Solar.com).

Rotary switch A position	Rotary switch B position	Country data set	Display language
0	0	Default settings	Default settings
0	1	Retained	English
0	2	Retained	German
0	3	Retained	French

Rotary switch A position	Rotary switch B position	Country data set	Display language
0	4	Retained	Spanish
0	5	Retained	Italian
0	6	Retained	Greek
0	7	Retained	Czech
0	8	Retained	Korean
0	9	Retained	Portuguese
0	A	Retained	Dutch
0	B	Retained	Slovenian
0	C	Retained	Bulgarian
0	D	Retained	Polish
1	0	VDE0126-1-1	German
1	2	VDE-AR-N 4105*	German
1	4	VDE-AR-N 4105-MP**	German
1	6	VDE-AR-N 4105-HP***	German
1	8	VDE0126-1-1	French
1	9	VDE0126-1-1/UTE	French
2	0	VDE0126-1-1	Italian
2	8	AS477.3****	English
4	1	RD1663/661-A****	Spanish
4	8	PPC****	Greek
4	9	PPC****	English
5	8	G83/1-1****	English
6	0	EN50438****	German
6	1	EN50438****	English
6	2	EN50438****	French
6	3	EN50438****	Italian
6	4	EN50438****	Spanish
6	5	EN50438****	Greek
6	6	EN50438****	Czech
6	7	EN50438****	Portuguese
6	8	EN50438****	Bulgarian

Rotary switch A position	Rotary switch B position	Country data set	Display language
6	9	EN50438****	Polish
7	0	EN50438-CZ****	Czech
7	1	EN50438-CZ****	English
7	2	EN50438-CZ****	German
7	4	PPDS****	Czech
7	5	PPDS****	English
7	6	PPDS****	German
7	8	C10/11****	French
7	9	C10/11****	English
7	A	C10/11****	German
7	B	C10/11****	Dutch
A	C	SI4777-2****	English
B	8	IEC61727/MEA****	English
B	C	IEC61727/PEA****	English
D	0	Island mode 60 Hz****	English
D	1	Island mode 60 Hz****	German
D	2	Island mode 60 Hz****	French
D	3	Island mode 60 Hz****	Spanish
D	4	Island mode 60 Hz****	Italian
D	5	Island mode 60 Hz****	Greek
D	6	Island mode 60 Hz****	Czech
E	0	Island mode 50 Hz****	English
E	1	Island mode 50 Hz****	German
E	2	Island mode 50 Hz****	French
E	3	Island mode 50 Hz****	Spanish
E	4	Island mode 50 Hz****	Italian
E	5	Island mode 50 Hz****	Greek
E	6	Island mode 50 Hz****	Czech

* Setting in accordance with VDE-AR-N 4105 for plants ≤ 3.68 kVA (Germany)

** Setting in accordance with VDE-AR-N 4105 for plants from 3.68 kVA to 13.8 kVA (Germany)

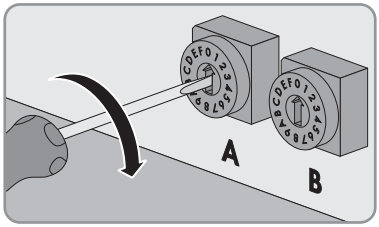
*** Setting in accordance with VDE-AR-N 4105 for plants > 13.8 kVA (Germany)

**** Planned

7.2 Changing the Country Data Set and the Display Language

By default, the inverter is set to a specific country data set. You will find the country data set to which the inverter has been configured on the type label and the enclosed supplementary sheet with the default settings. If the country data set of the inverter does not apply to your country, you must change the country data set and the display language. You can change this via two rotary switches before commissioning. You can also change the display language independently of the country data set (see Section 7.3). If the inverter is in operation, you can change the country data set by means of a communication product (see Section 9.4).

1. Disconnect the inverter from voltage sources (see Section 10).
2. Set the rotary switches **A** and **B** to the desired position using a slotted screwdriver (blade width: 2.5 mm) (see Section 7.1 "Overview of the Rotary Switches", page 52).

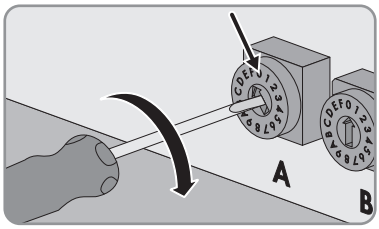


3. Recommission the inverter (see Section 8).
   ☑ The inverter will adopt the setting after commissioning. This can take up to five minutes.

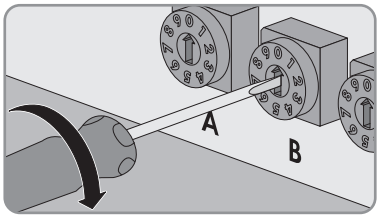
7.3 Changing the Display Language Independently of the Country Data Set

If a country data set has been configured and the corresponding display language is not the language you prefer, you can change the display language independently of the country data set.

1. Disconnect the inverter from voltage sources (see Section 10).
2. Set the rotary switch **A** to **0** using a slotted screwdriver (blade width: 2.5 mm). This ensures that the country data set remains unchanged.



3. Set the rotary switch **B** to the desired language using a slotted screwdriver (blade width: 2.5 mm) (see Section 7.1 "Overview of the Rotary Switches", page 52).



4. Recommission the inverter (see Section 8).
   ☑ The inverter will adopt the setting after commissioning. This can take up to five minutes.

7.4 Setting the NetID

By default, the NetID is set to **1** for all SMA inverters and SMA communication products. This means that the inverter can communicate with one SMA communication product via *Bluetooth*.

You may leave the default NetID set to 1 in your inverter if your plant consists of the following products:

- A maximum of one inverter
- A maximum of one computer with *Bluetooth* and the Sunny Explorer software
- A maximum of one communication product

  or

- A maximum of one inverter
- A maximum of two communication products

You must change the NetID in the following cases:

- If your plant consists of more than one inverter and two communication products, you must change the NetID of your plant. This will enable you to communicate with other inverters and several communication products.
- If another plant with *Bluetooth* is located within 500 m of your plant (i.e. in your vicinity), you must change the NetID of your plant. This will help to separate both plants from each other.
- If you do not want to communicate using *Bluetooth*, deactivate the *Bluetooth* communication on your inverter. This protects your plant from unauthorised access.

All *Bluetooth* devices in a plant must have the same NetID. Before commissioning, you can set a new NetID in the inverter by using one rotary switch. The setting will be adopted after commissioning.

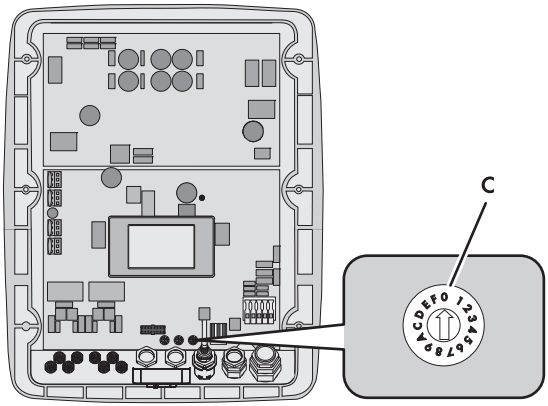
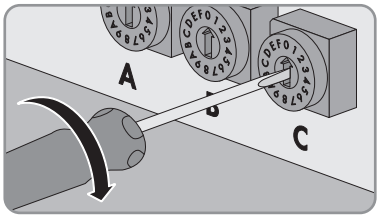


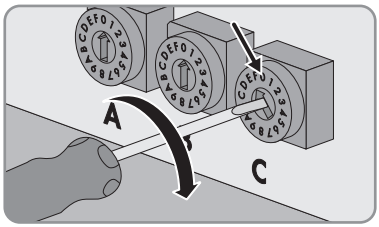
Figure 18: Positions of rotary switch C

Position	Explanation
0	Communication via *Bluetooth* is deactivated.
1	Communication via *Bluetooth* with one communication product.
2 ... F	NetID for communication with other inverters and several communication products via *Bluetooth*.

1. Disconnect the inverter from voltage sources (see Section 10).
2. Determine a free NetID using the Sunny Explorer software (see documentation of the Sunny Explorer software).
3. To configure a new NetID, set the rotary switch **C** to the determined NetID using a slotted screwdriver (blade width: 2.5 mm).



4. To deactivate the communication via *Bluetooth*, set the rotary switch **C** to the position **0** using a slotted screwdriver (blade width: 2.5 mm). This protects your plant from unauthorised access.



5. Recommission the inverter (see Section 8).

   ☑ The inverter will adopt the setting after commissioning. This can take up to five minutes.

8 Commissioning

8.1 Commissioning the Inverter for the First Time

When commissioning the inverter for the first time, proceed as follows.

Requirements:

- ☐ The miniature circuit-breaker must be correctly rated.
- ☐ The inverter must be correctly mounted and closed.
- ☐ All cables must be correctly connected.
- ☐ Unused DC inputs must be sealed using the corresponding DC connectors and sealing plugs.
- ☐ The protective cover must be correctly mounted.
- ☐ The ESS must be securely plugged in.

1. Switch on the miniature circuit-breaker.
2. If a multi-function relay is used, switch on the load supply voltage.
   - ☑ The start-up phase begins. All three LEDs are lit or flashing.
   - ☑ The green LED is lit and the display alternates automatically between the firmware version, the serial number of the inverter, the NetID, the IP address, the subnet mask, the configured country data set and the display language.
   - ✖ Is the green LED flashing?

     Possible cause of the error: The DC input voltage is still too low.
     - If the DC input voltage is sufficiently high, the inverter starts to operate.
   - ✖ The red LED is lit and an error message and event number appear in the display?
     - Eliminate the error (see Section 11 "Troubleshooting", page 68).

8.2 Recommissioning the Inverter

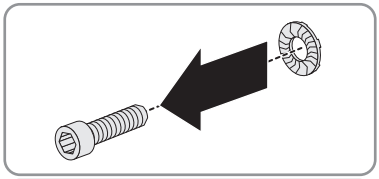
If you have disconnected the inverter from voltage sources (e.g. for configuration purposes) and want to recommission it, proceed as follows.

Requirements:

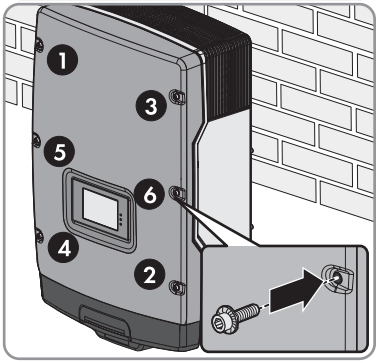
☐ The miniature circuit-breaker must be correctly rated.

☐ The inverter must be correctly mounted.

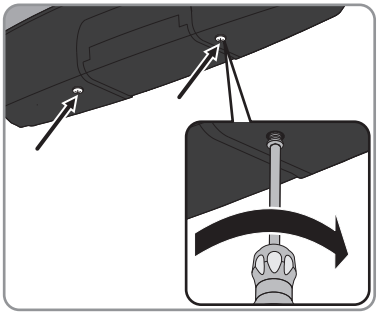
1. Close the inverter and earth the enclosure lid:
   - Attach one conical spring washer on each screw. The grooved side of the conical spring washer must point to the screw head.



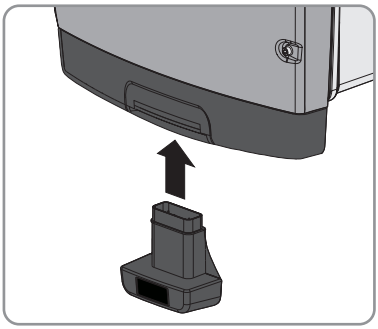
   - Secure the enclosure lid in the sequence 1 to 6 (torque: 6 Nm) using an Allen key (AF 5).
   ☑ The teeth of the conical spring washers are pushed into the enclosure lid. This earths the enclosure lid.



2. Connect the DC connectors to the inverter.
3. Seal all unused DC inputs using the DC connectors with sealing plugs.
4. Secure the protective cover using two screws and an Allen key (AF 5).



5. Securely plug in the ESS.



6. Switch on the miniature circuit-breaker.
7. If a multi-function relay is used, switch on the load supply voltage.
   ☑ The start-up phase begins. All three LEDs are lit or flashing.
   ☑ The green LED is lit and the display alternates automatically between the firmware version, the serial number of the inverter, the NetID, IP address, subnet mask, the configured country data set and display language.
   ✖ Is the green LED flashing?

   Possible cause of the error: The DC input voltage is still too low.
   - If the DC input voltage is sufficiently high, the inverter starts to operate.

   ✖ The red LED is lit and an error message and event number appear in the display?
   - Eliminate the error (see Section 11 "Troubleshooting", page 68).

9 Configuration

9.1 Changing the Plant Time and Plant Password

Requirements:

☐ A computer with *Bluetooth* interface must be available.

☐ Sunny Explorer with software version 1.04 or higher must be installed on the computer.

☐ The plant must be logged in Sunny Explorer.

- Change the standard plant password (see Sunny Explorer help). This protects your plant from unauthorised access.
- Change the plant time (see Sunny Explorer help).

9.2 Integrating the Inverter into the Network

If the router supports DHCP, the inverter will automatically be integrated in the network. If the router does not support DHCP, integrate the inverter in the network as shown in the following procedure.

Requirements:

☐ If the inverter is to be integrated in the network via *Bluetooth*, the inverter must be directly connected to a network.

☐ If the inverter is to be integrated in the network via *Bluetooth*, there must be a computer with a *Bluetooth* interface available that is connected to the same network as the inverter.

☐ If the inverter is to be integrated into the network with a computer directly via Speedwire, there has to be one network cable available and DHCP must be activated on the computer.

☐ Sunny Explorer with software version 1.04 or higher must be installed on the computer.

☐ The plant must be logged in Sunny Explorer.

1. If the inverter is to be integrated into the network with a computer directly via Speedwire, connect the computer and the inverter by means of a network cable.
   - Remove the filler-plugs from the socket in order to connect the inverter to the network.
   - Plug the network cable in the socket in order to connect the inverter to the network.
2. Access the user interface of the Sunny Explorer and log in as an installer.
3. Select the inverter in the plant tree.
4. Select the "**Settings**" tab in the device menu.
5. Select the parameter group **Plant Communication > Speedwire**.
6. Select [**Edit**].
7. In the dropdown list **Automatic configuration switched on**, select the entry **No**. This will deactivate the DHCP.
8. In the **IP Address** field, adjust the IP address of the inverter to the network.
9. In the **Subnet mask** field, adjust the subnet mask of the inverter to the network.

10. In the **Gateway IP** field, set the IP address of the gateway.
11. In the **DNS server IP** field, set the IP address of the DNS server.
12. Select [**Save**].

9.3 Connecting the Inverter to Sunny Portal

Requirements:

☐ The inverter must be connected to a network with Internet connection.

- Connect the inverter to Sunny Portal and register in Sunny Portal (see the user manual of the inverter in Sunny Portal)

9.4 Changing the Country Data Set via Communication

Requirements:

☐ A communication product that is appropriate for the type of communication used must be available.

☐ The changes to the grid-relevant parameters must be approved by the responsible network operator.

☐ An SMA Grid Guard code for changing the grid-relevant parameters must be available (see certificate "Application for SMA Grid Guard-Code" at www.SMA-Solar.com).

1. Access the user interface of the communication product.
2. Enter the SMA Grid Guard code.
3. Select the **Set country standard** parameter and adjust the required country data set.
4. Save settings.

9.5 Changing the Operating Mode of the Multi-Function Relay

By default, the multi-function relay is set to activate a fault indicator when an error occurs. If you use the multi-function relay for another purpose, you must change the operating mode.

1. Select the parameter **Operating mode of multifunction relay** and set the desired operating mode (for information on the operating modes, see Section 4.6 "Multi-Function Relay", page 23).
2. Once you have set the operating mode **Self-consumption**, you can carry out other settings:
   - Select the parameter **Minimum On time for MFR self-consumption** and set the desired value. By doing this, you are setting the power threshold from which a load is to be activated.
   - Select the parameter **Minimum On power for MFR self-consumption** and set the desired value. By doing this, you are setting the minimum time for which the power must have exceeded the minimum switch-on power threshold in order to trip activation of the load.
   - Select the parameter **Minimum On time for MFR self-consumption** and set the desired value. By doing this, you are setting the minimum time for which the load remains activated.
3. If you have set the operating mode **Control via communication**, select the parameter **Status of MFR with control via communication** and set the desired value. By doing this, you are setting the status at which the multi-function relay is controlled via a communication product.
4. If you have set the operating mode **Battery bank**, carry out other settings:
   - Select the parameter **Minimum On power of MFR battery bank** and set the desired value. By doing this, you are setting the power threshold from which the battery is to be charged.
   - Select the parameter **Minimum time before reconnection of MFR battery bank** and set the desired value. By doing this, you are setting the minimum time which must elapse after charging of the battery before the battery can be charged once more.

9.6 Activating and Setting SMA OptiTrac Global Peak

With partially shaded PV modules, you should activate SMA OptiTrac Global Peak and set the time interval in which the inverter can optimise the MPP of the PV plant.

Requirements:

☐ A communication product that is appropriate for the type of communication used must be available.

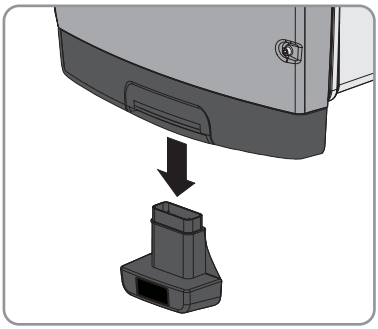
1. Access the user interface of the communication product and log in as an installer.
2. Select the parameter **OptiTrac Global Peak switched on** and set to **On**.
3. Select the parameter **Cycle time of the OptiTrac Global Peak algorithm** and set the desired time interval. Hint: The ideal time interval is usually six minutes. The value should only be increased if the shading situation changes extremely slowly.

   ☑ The inverter optimises the MPP of the PV plant in the predetermined time interval.

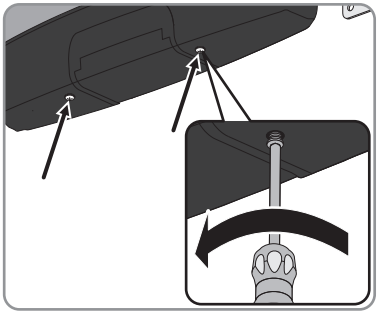
10 Disconnecting the Inverter from Voltage Sources

Always disconnect the inverter from voltage sources before performing any work on it as described in this section.

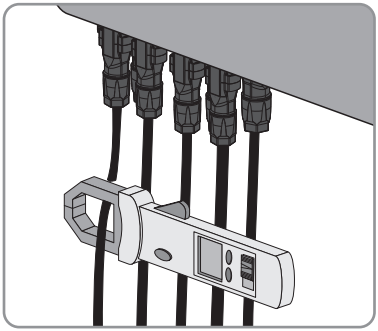
1. Disconnect the miniature circuit-breaker and secure against reconnection.
2. Remove the ESS.



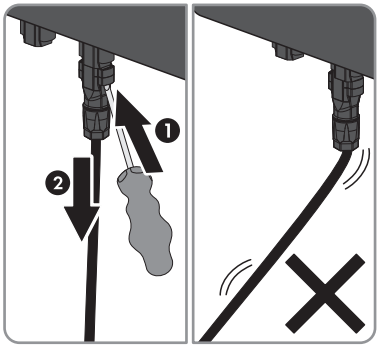
3. Loosen two screws of the protective cover using an Allen key (AF 5) and remove the protective cover.



4. Use a current clamp to ensure that no current is present in the DC cables.



5. Release and remove all DC connectors. To do this, insert a slotted screwdriver (blade width: 3.5 mm) into one of the side slots and pull the DC connectors straight out. Do **NOT PULL ON THE CABLE**.



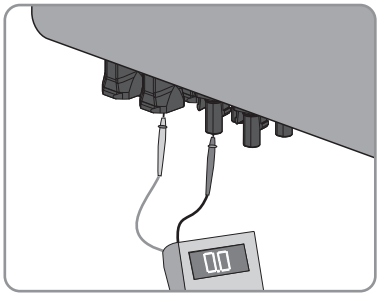
6. **⚠ DANGER**

   Danger to life due to high voltages

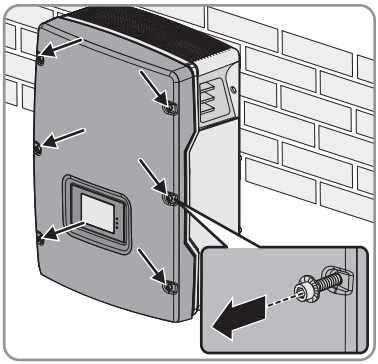
   The capacitors in the inverter take five minutes to discharge.

   - Wait five minutes before opening the enclosure lid.

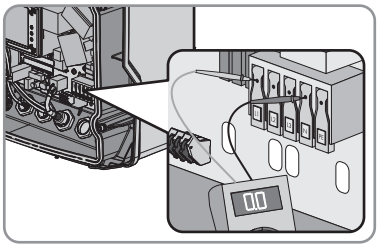
7. Ensure that no voltage is present at the DC inputs of the inverter.



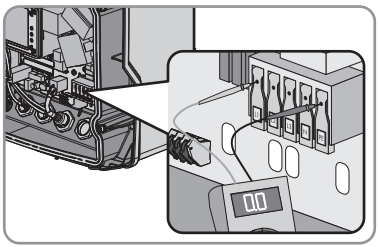
8. Loosen all screws of the enclosure lid using an Allen key (AF 5) and remove the enclosure lid.



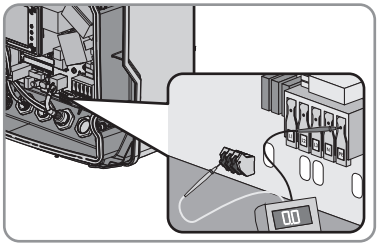
9. Ensure that no voltage is present between **L1** and **N**, **L2** and **N,** as well as between **L3** and **N** on the AC connecting terminal plate one after another using a suitable measuring device. Insert a test probe in each round opening of the terminal.



10. Ensure that no voltage is present between **L1** and **PE**, **L2** and **PE**, as well as between **L3** and **PE** on the AC terminal one after another by using a suitable measuring device. Insert a test probe in each round opening of the terminal.



11. Ensure that no voltage is present between all terminals of the multi-function relay and **PE**.



12. ***NOTICE***

Damage to the inverter due to electrostatic discharge

The internal components of the inverter can be irreparably damaged by electrostatic discharge.

- Earth yourself before touching any components.

11 Troubleshooting

11.1 LED Signals

The LEDs indicate the operating state of the inverter.

Description	Status	Explanation
Green LED	Is lit	Operation In case of an event, the event message is shown in the display (see Section 11.2).
	Flashing	The requirements for the connection to the electricity grid have not been met.
Red LED	Is lit	Error The display shows the error message and event number (see Section 11.3).
Blue LED	Is lit	*Bluetooth* communication is activated.

11.2 Event Messages

Display message	Cause
Update file OK	The update file found is valid.
SD card is read	The inverter is currently reading the SD card.
No new update SDcard	There are no update files relevant for this inverter on the SD card or the available update has already been carried out.
Grid param. locked	The parameters have been blocked and cannot be changed.
Abort self-test	The self-test was stopped due to DC voltage being too low.
Update communication	The inverter updates the communication component.
Update main CPU	The inverter updates the inverter component.
Update Bluetooth	The inverter updates the *Bluetooth* component.
Upd. language table	The inverter updates the language table.
Update completed	The inverter has successfully completed the update.
Grid param.unchanged	The selected rotary switch position is not assigned or it is not possible to change the grid parameters.
Inst. code valid	The SMA Grid Guard code entered is valid. Protected parameters have now been unblocked and you can adjust the parameters. The parameters are automatically locked again after ten feed-in hours.
Self-test	The self-test is being carried out.

11.3 Error Messages

Event number	Display message	Cause and corrective measures
101 ... 103	Grid fault	The line voltage or grid impedance at the termination point of the inverter is too high. The inverter has disconnected from the electricity grid. **Corrective measures:** • Check that the line voltage at the termination point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the network operator. Ask the network operator whether the voltage can be adapted at the feed-in point or if it would be acceptable to change the monitored operating limits. If the line voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.
202 ... 203	Grid fault	The electricity grid has been disconnected, the AC cable is damaged or the line voltage at the termination point of the inverter is too low. The inverter has disconnected from the electricity grid. **Corrective measures:** • Ensure that the miniature circuit-breaker is switched on. • Ensure that the AC cable is not damaged. • Ensure that the AC cable is connected correctly. • Check that the line voltage at the termination point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the network operator. Ask the network operator whether the voltage can be adapted at the feed-in point or if it would be acceptable to change the monitored operating limits. If the line voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.

Event number	Display message	Cause and corrective measures
301	Grid fault	The 10-minute average line voltage is no longer within the permissible range. The line voltage or grid impedance at the termination point is too high. The inverter disconnects from the electricity grid to comply with the power quality. **Corrective measures:** • Check that the line voltage at the termination point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the network operator. Ask the network operator whether the voltage can be adapted at the feed-in point or if it would be acceptable to change the monitored operating limits. If the line voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.
401	Grid fault	The inverter is no longer in grid-parallel operation. The inverter has stopped feeding into the electricity grid. **Corrective measures:** • Check the grid connection for strong, short-term frequency variations.
404	Grid fault	The inverter is no longer in grid-parallel operation. The inverter has stopped feeding into the electricity grid. **Corrective measures:** • Check the grid connection for strong, short-term frequency variations.

Event number	Display message	Cause and corrective measures
501	Grid fault	The power frequency is not within the permissible range. The inverter has disconnected from the electricity grid. **Corrective measures:** • As far as possible, check the power frequency and observe how often fluctuations occur. If there is a high number of fluctuations and this message is displayed frequently, contact the network operator and ask whether they approve a change of the operating parameters of the inverter. If the network operator approves, discuss any changes to the operating parameters with the SMA Service Line.
601	Grid fault	The inverter has detected an excessively high proportion of direct current in the line current. **Corrective measures:** • Check the grid connection for direct current. • If this message is displayed frequently, contact the network operator and check whether it is possible to raise the limiting value for monitoring on the inverter.
701	Frq. not permitted Check parameter	The power frequency is not within the permissible range. The inverter has disconnected from the electricity grid. **Corrective measures:** • As far as possible, check the power frequency and observe how often fluctuations occur. If there is a high number of fluctuations and this message is displayed frequently, contact the network operator and ask whether they approve a change of the operating parameters of the inverter. If the network operator approves, then discuss any changes to the operating parameters with the SMA Service Line.

Event number	Display message	Cause and corrective measures
1302	Waiting for grid voltage Installation failure grid connection Check grid and fuses	The inverter has detected an error in the AC cabling or the potential difference between N and PE in the building installation is above 50 V. The inverter cannot connect to the electricity grid. **Corrective measures:** • Ensure that the AC connection is correct (see Section 6.3.2). • Ensure that there is no potential difference between N and PE in the building installation. • Ensure that the country data set has been configured correctly. Check the setting of the rotary switches **A** and **B** or select the parameter **Set country standard** and check the value.
1501	Reconnection fault grid	The changed country data set or the value of a parameter you have set does not correspond to the local requirements. The inverter cannot connect to the electricity grid. **Corrective measures:** • Ensure that the country data set has been configured correctly. Check the setting of the rotary switches **A** and **B** or select the parameter **Set country standard** and check the value.

Event number	Display message	Cause and corrective measures
3301 ... 3303	Unstable operation	The 10-minute average line voltage is no longer within the permissible range. The line voltage or grid impedance at the termination point is too high. The inverter disconnects from the electricity grid to comply with the power quality. **Corrective measures:** • Check that the line voltage at the termination point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the network operator. Ask the network operator whether the voltage can be adapted at the feed-in point or if it would be acceptable to change the monitored operating limits. If the line voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.
3401 ... 3402	DC overvoltage Disconnect generator	Overvoltage at the DC input. The inverter may be destroyed. This message is additionally indicated by rapid flashing of the backlight. **Corrective measures:** • **DISCONNECT** the inverter **IMMEDIATELY** (see Section 10). • Check the DC voltage to ensure it is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, reconnect the DC connectors to the inverter. • If the DC voltage is above the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the PV array installer. • If this message is repeated frequently, contact the SMA Service Line.

Event number	Display message	Cause and corrective measures
3501	Insulation resist. Check generator	The inverter has detected an earth fault in the PV array. **Corrective measures:** • Check the PV plant for earth faults (see Section 11.5).
3601	High discharge curr. Check generator	The leakage current from the inverter and the PV array is too high. This can be caused by an earth fault, a residual current or a malfunction. The inverter interrupts feed-in operation immediately after exceeding a limiting value and then automatically reconnects to the electricity grid. **Corrective measures:** • Check the PV plant for earth faults (see Section 11.5).
3701	Resid.curr.too.high Check generator	The inverter has detected a residual current through brief PV array earthing. **Corrective measures:** • Check the PV plant for earth faults (see Section 11.5).
3801 ... 3802	DC overcurrent Check generator	Overcurrent at the DC input. The inverter briefly interrupts feed-in. **Corrective measures:** • If this message is displayed frequently, ensure that the PV array has been correctly rated and wired.
3901 ... 3902	Waiting for DC start conditions Start cond. not met	The requirements for the feed-in to the electricity grid have not been met. **Corrective measures:** • Wait for more irradiation. • If this message is displayed frequently in the morning, increase the limiting voltage to start the feed-in. To do this, change the parameter **Minimum voltage input**. • If this message is displayed frequently with medium irradiation, ensure that the PV array is correctly rated.

Event number	Display message	Cause and corrective measures
6001 ... 6009	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6101 ... 6112	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6201 ... 6203	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6301	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** Contact the SMA Service Line.
6304 ... 6306	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** Contact the SMA Service Line.
6401 ... 6416	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6422	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6433	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.

Event number	Display message	Cause and corrective measures
6437 ... 6438	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6501 ... 6502	Self diagnosis Overtemperature	The inverter has switched off due to an excessive temperature. **Corrective measures:** • Clean the fans (see Section 11.8). • Ensure that the inverter has sufficient ventilation.
6509	Self diagnosis Overtemperature	The inverter has switched off due to an excessive temperature. **Corrective measures:** • Clean the fans (see Section 11.8). • Ensure that the inverter has sufficient ventilation.
6511	Overtemperature	The inverter has switched off due to an excessive temperature. **Corrective measures:** • Clean the fans (see Section 11.8). • Ensure that the inverter has sufficient ventilation.
6603 ... 6604	Self diagnosis Overload	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6801 ... 6802	Self diagnosis Input A defective	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6901 ... 6902	Self diagnosis Input B defective	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.

Event number	Display message	Cause and corrective measures
7001 ... 7002	Sensor fault fan permanently on	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
7401	Varistor defective	At least one of the thermally monitored varistors is defective. **Corrective measures:** • Check the function of the varistors (see Section 11.6).
7701 ... 7703	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
8001	Derating occurred	The inverter has reduced its power output for more than ten minutes due to an excessive temperature. **Corrective measures:** • If this message is displayed frequently, clean the fans (see Section 11.8). • Ensure that the inverter has sufficient ventilation.
8101 ... 8104	Comm. disturbed	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.

Event number	Display message	Cause and corrective measures
8801 ... 8803	No display	This error message can have three causes, yet the inverter still continues to feed into the electricity grid. The ambient temperature is lower than –25°C. The display switched off for protection. The inverter cannot identify the display type. No display is connected to the inverter or the connection is defective. **Corrective measures:** • If the display switched off due to the ambient temperature being too low, wait until the ambient temperature is over –25°C. • If the ambient temperature is over –25°C, contact the SMA Service Line.
9002	Inst. code invalid	The SMA Grid Guard code entered is incorrect. The parameters are still protected and cannot be changed. **Corrective measures:** • Enter the correct SMA Grid Guard code.
9003	Grid param. locked	The parameters are now locked. The parameters cannot be changed. **Corrective measures:** • Unlock the parameters with the SMA Grid Guard code.

11.4 Cleaning the Inverter

- ***NOTICE***

  Damage to the display by use of cleaning agents

  • If the inverter is dirty, clean the enclosure lid, the display and the LEDs using only clean water and a cloth.

11.5 Checking the PV Plant for Earth Faults

If the inverter displays the event numbers **3501**, **3601** or **3701**, there could be an earth fault. The electrical insulation of the PV plant to earth is defective or insufficient.

⚠ WARNING

Danger to life due to electric shock

In the event of an earth fault, high voltages can be present at the PV array.

- Only touch the insulation of the PV array cables.
- Do not touch parts of the sub-structure and frame of the PV array.
- Do not connect strings with earth faults to the inverter.

NOTICE

Destruction of the measuring device due to overvoltage

- Only use measuring devices with a DC input voltage range up to at least 1,000 V.

Proceed as follows to check each string in the PV plant for earth faults.

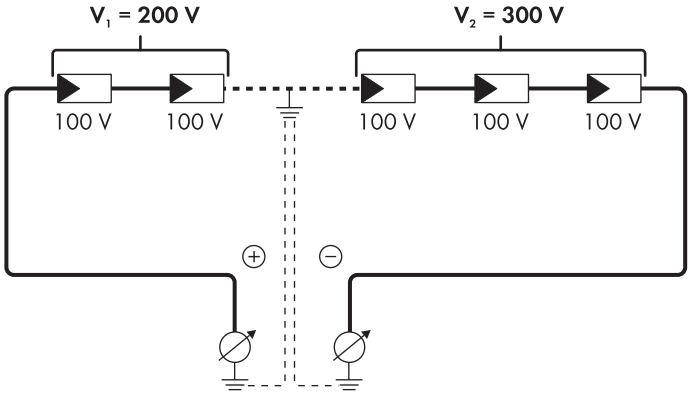
1. Disconnect the inverter from voltage sources (see Section 10).
2. Measure voltages:
   - Measure the voltages between the positive pole and the earth potential (PE).
   - Measure the voltages between the negative pole and the earth potential (PE).
   - Measure the voltages between the positive and negative poles.

   If the following results are present at the same time, there is an earth fault in the PV plant.
   - All measured voltages are stable.
   - The sum of the two voltages against the earth potential (PE) is approximately the same as the voltage between the positive and negative poles.
   - Determine the location of the earth fault via the ratio of the two measured voltages.
   - Eliminate the earth fault.

   If there is no earth fault and the message is still displayed, contact the SMA Service Line.

Example: Location of the earth fault

The example shows an earth fault between the second and third PV module.



3. Recommission the inverter (see Section 8).

11.6 Checking the Function of the Varistors

If the inverter displays event number **7401**, one of the varistors is probably defective. Check the function of each varistor as described below.

NOTICE

Destruction of the inverter due to overvoltage

If varistors are missing, the inverter is no longer protected against overvoltage.

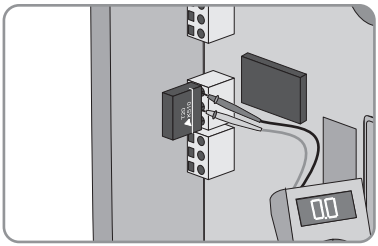
- Do not operate the inverter without varistors in plants with a high risk of overvoltages.
- Do not recommission the inverter until the defective varistors have been replaced.

NOTICE

Destruction of the measuring device due to overvoltage

- Only use measuring devices with a DC input voltage range up to 1,000 V.

1. Disconnect the inverter from voltage sources (see Section 10).
2. Use a measuring device to measure whether there is a conductive connection between the upper and the middle connection wire.



If there is no conductive connection present, the varistor is defective. SMA Solar Technology AG recommends replacing all varistors immediately.

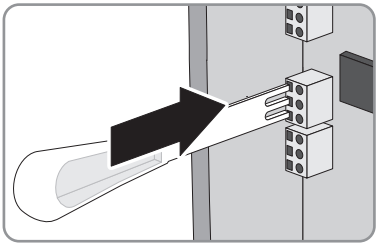
- Order new varistors and a new insertion tool (see Section 14 "Accessories", page 103).
- If new varistors are available, replace all varistors (see Section 11.7).

If a conductive connection is present, contact the SMA Service Line.

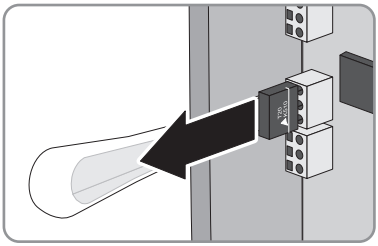
11.7 Replacing the Varistors

Proceed as follows to replace each varistor.

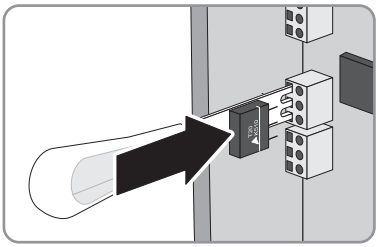
1. Disconnect the inverter from voltage sources (see Section 10).
2. Insert the insertion tool into the contacts of the terminal block.



3. Remove the varistor from the terminal block.



4. Insert the new varistor into the terminals of the terminal block. The labels of the varistor must face to the right in the inside of the inverter.



5. Remove the insertion tool from the contacts of the terminal block.
6. Recommission the inverter (see Section 8).

11.8 Cleaning the Fans

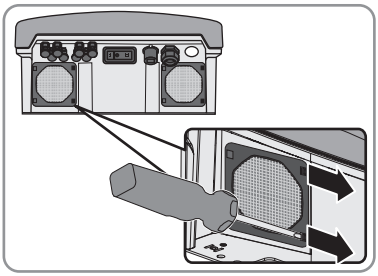
Proceed as follows to clean each fan.

1. Disconnect the inverter from voltage sources (see Section 10).
2. Wait for the fans to stop rotating.
3. Check whether the fan guard is dusty or heavily soiled.

   If the fan guard is dusty, clean the fan guard with a vacuum cleaner.

   If the fan guard is heavily soiled, remove the fan guard and clean it:

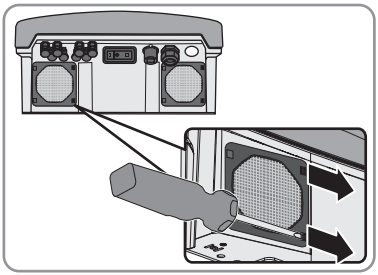
   - Use a screwdriver to push the two locking tabs at the right edge of the fan guard to the right and remove them from the retainer.



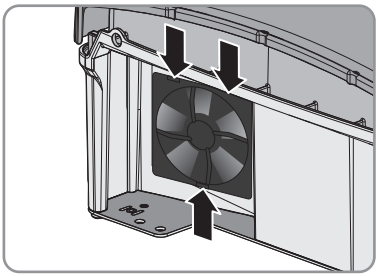
   - Carefully remove the fan guard.
   - Clean the fan guard with a soft brush, a paint brush, a cloth or compressed air.
4. Check whether the fan is soiled.

If the fan is soiled, remove the fan:

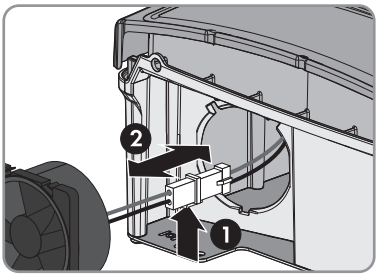
- Use a screwdriver to push the two latches at the right edge of the fan guard to the right and remove them from the retainer.



- Carefully remove the fan guard.
- Push the latches of the fan towards the middle of the fan.



- Remove the fan slowly from the inverter.
- Unlock and remove the fan plug.

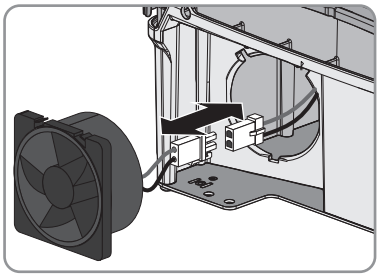


NOTICE

Damage to the fan due to compressed air

- Clean the fan with a soft brush, a paint brush, or a damp cloth.

5. Insert the plug of the fan into the socket until it clicks into place.



6. Insert the fan into the inverter until the fan audibly clicks into place.
7. Push the fan guard into the retainer until it audibly clicks into place.
8. Recommission the inverter (see Section 8).
9. Check the fan to ensure that it is functioning properly (see Section 11.9).

11.9 Checking the Fans

You can check the function of the fans by setting a parameter.

Requirements:

☐ A communication product that is appropriate for the type of communication used must be available.

1. Access the user interface of the communication product and log in as an installer.
2. Select the **Fan test** parameter and set to **On**.
3. Save settings.
4. Check whether air is coming out of the ventilation grids and whether the fans are making any unusual noises.

   If there is no air coming out of the ventilation grids or the fans are making unusual noises, presumably the fans were not assembled properly. Check the assembly of the fans.

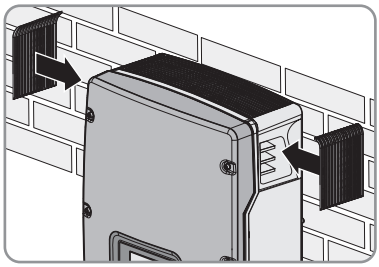
   If despite proper assembly, there is nevertheless no air being released through the ventilation grids or the fans are making unusual noises, contact the SMA Service Line.
5. Select the **Fan test** parameter and set to **Off**.
6. Save settings.

11.10 Cleaning the Ventilation Grids

1. Remove the ventilation grids to the sides.
2. **NOTICE**

   Damage to the inverter due to foreign bodies

   - Do not remove the ventilation grids permanently, otherwise foreign bodies could enter into the enclosure.
3. Clean the ventilation grids with a soft brush, a paint brush, or compressed air.
4. Close the recessed grips with the ventilation grids. Ensure that the assignment is correct. Each ventilation grid is assigned to an enclosure side on the inside: **links/left** for the left-hand side and **rechts/right** for the right-hand side.



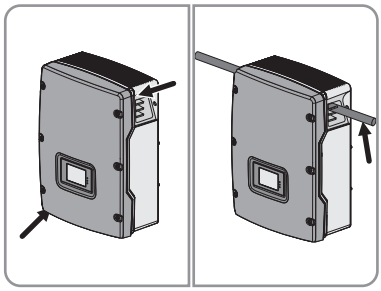
12 Decommissioning

12.1 Dismantling the Inverter

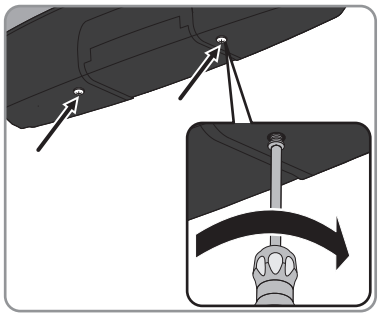
⚠ CAUTION

Risk of injury due to the heavy weight of the inverter

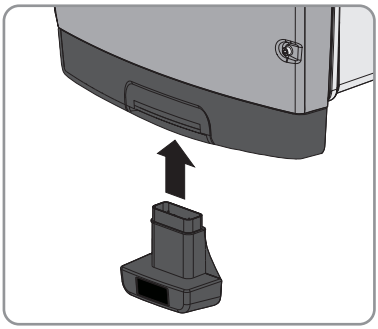
- Take the weight of the inverter into account (see Section 13 "Technical Data", page 90).
- Transport the inverter horizontally, using the recessed grips on the sides or one steel rod (diameter: 30 mm at maximum).



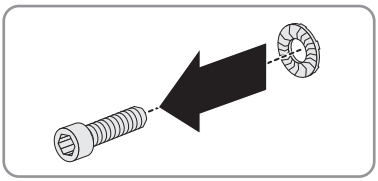
1. Disconnect the inverter from voltage sources (see Section 10).
2. Remove the AC cable from the inverter.
3. If an Ethernet cable is connected for Speedwire communication, remove the cable from the inverter.
4. Secure the protective cover using two screws and an Allen key (AF 5).



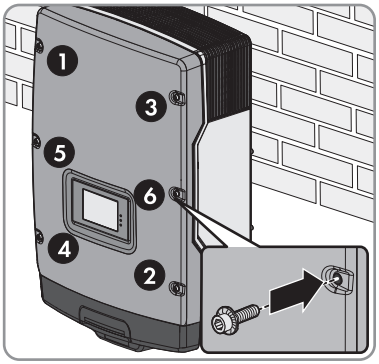
5. Securely plug in the ESS.



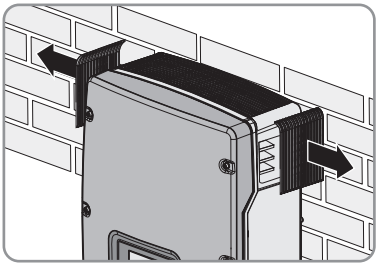
6. Close the inverter:
   - Attach one conical spring washer on each screw. The grooved side of the conical spring washer must point to the screw head.



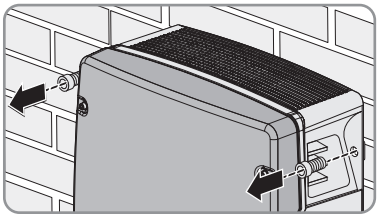
   - Secure the enclosure lid in the sequence 1 to 6 (torque: 6 Nm) using an Allen key (AF 5).



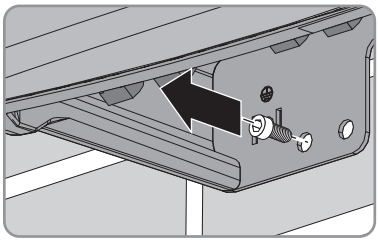
7. Remove the ventilation grids to the sides.



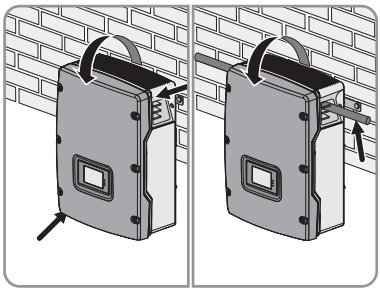
8. Loosen the screws on both sides between the inverter and the wall mounting bracket using an Allen key (AF 5).



9. If the inverter is protected against theft, loosen the safety screws.

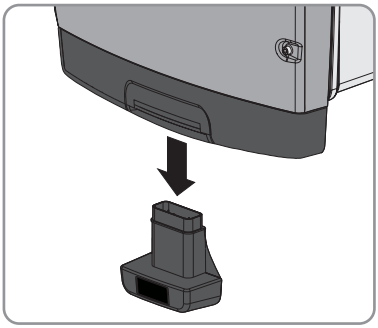


10. Remove the inverter by lifting it up and out of the wall mounting bracket.

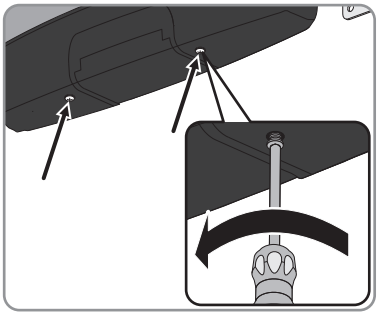


12.2 Packing the Inverter

1. If the ESS is plugged in, remove the ESS.



2. If the protective cover is mounted, loosen the two screws of the protective cover using an Allen key (AF 5) and remove the protective cover.



3. Remove the cable glands from the inverter.
4. Package the inverter, cable glands, protective cover and ESS. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter.

12.3 Disposing of the Inverter

- Dispose of the inverter in accordance with the locally applicable disposal regulations for electronic waste.

  or

  Return the inverter to SMA Solar Technology AG at your own expense (see Section 15 "Contact", page 104). Label the package "ZUR ENTSORGUNG" ("FOR DISPOSAL").

13 Technical Data

13.1 DC/AC

13.1.1 Sunny Tripower 5000TL

DC Input

Maximum DC power at cos φ = 1	5,100 W
Maximum input voltage*	1,000 V
MPP voltage range	245 V ... 800 V
Rated input voltage	580 V
Minimum input voltage	150 V
Initial input voltage	188 V
Maximum input current, input A	11 A
Maximum input current, input B	10 A
Maximum input current per string, input A**	11 A
Maximum input current per string, input B**	10 A
Number of independent MPP inputs	2
Strings per MPP input	2

* The maximum open-circuit voltage, which can occur if the cell temperature is at − 10°C, must not exceed the maximum input voltage.

** Maximum permitted current which may flow via one DC connector.

AC Output

Rated power at 230 V, 50 Hz	5,000 W
Maximum apparent AC power	5,000 VA
Rated grid voltage	230 V
Nominal AC voltage at 220 V	380 V
Nominal AC voltage at 230 V	400 V
Nominal AC voltage at 240 V	415 V
AC voltage range*	160 V ... 280 V
Nominal AC current at 220 V	7.3 A
Nominal AC current at 230 V	7.3 A
Nominal AC current at 240 V	6.9 A
Maximum output current	7.3 A
Total harmonic factor of the output current at total harmonic factor of the AC voltage < 2%, and AC power > 50% rated power	≤ 3%
Rated power frequency	50 Hz
AC power frequency*	50 Hz/60 Hz
Operating range at AC power frequency 50 Hz	45.5 Hz ... 54.5 Hz
Operating range at AC power frequency 60 Hz	55.5 Hz ... 64.5 Hz
Displacement power factor cos φ, adjustable	0.8 overexcited ... 0.8 underexcited
Feed-in phases	3
Connection phases	3
Overvoltage category according to IEC 60664-1	III

* Depending on the configured country data set

Efficiency

Maximum efficiency, η_{max}	98%
Maximum efficiency, η_{EU}	97.3%

13.1.2 Sunny Tripower 6000TL

DC Input

Maximum DC power at cos φ = 1	6,125 W
Maximum input voltage*	1,000 V
MPP voltage range	295 V ... 800 V
Rated input voltage	580 V
Minimum input voltage	150 V
Initial input voltage	188 V
Maximum input current, input A	11 A
Maximum input current, input B	10 A
Maximum input current per string, input A**	11 A
Maximum input current per string, input B**	10 A
Number of independent MPP inputs	2
Strings per MPP input	2

* The maximum open-circuit voltage, which can occur if the cell temperature is at − 10°C, must not exceed the maximum input voltage.

** Maximum permitted current which may flow via one DC connector.

AC Output

Rated power at 230 V, 50 Hz	6,000 W
Maximum apparent AC power	6,000 VA
Rated grid voltage	230 V
Nominal AC voltage at 220 V	380 V
Nominal AC voltage at 230 V	400 V
Nominal AC voltage at 240 V	415 V
AC voltage range*	160 V ... 280 V
Nominal AC current at 220 V	8.7 A
Nominal AC current at 230 V	8.7 A
Nominal AC current at 240 V	8.33 A
Maximum output current	8.7 A
Total harmonic factor of the output current at total harmonic factor of the AC voltage < 2%, and AC power > 50% rated power	≤ 3%
Rated power frequency	50 Hz
AC power frequency*	50 Hz/60 Hz
Operating range at AC power frequency 50 Hz	45.5 Hz ... 54.5 Hz
Operating range at AC power frequency 60 Hz	55.5 Hz ... 64.5 Hz
Displacement power factor cos φ, adjustable	0.8 overexcited ... 0.8 underexcited
Feed-in phases	3
Connection phases	3
Overvoltage category according to IEC 60664-1	III

* Depending on the configured country data set

Efficiency

Maximum efficiency, η_{max}	98%
Maximum efficiency, η_{EU}	97.3%

13.1.3 Sunny Tripower 7000TL

DC Input

Maximum DC power at cos φ = 1	7,175 W
Maximum input voltage*	1,000 V
MPP voltage range	290 V ... 800 V
Rated input voltage	580 V
Minimum input voltage	150 V
Initial input voltage	188 V
Maximum input current, input A	15 A
Maximum input current, input B	10 A
Maximum input current per string, input A**	15 A
Maximum input current per string, input B**	10 A
Number of independent MPP inputs	2
Strings per MPP input	2

* The maximum open-circuit voltage, which can occur if the cell temperature is at − 10°C, must not exceed the maximum input voltage.

** Maximum permitted current which may flow via one DC connector.

AC Output

Rated power at 230 V, 50 Hz	7,000 W
Maximum apparent AC power	7,000 VA
Rated grid voltage	230 V
Nominal AC voltage at 220 V	380 V
Nominal AC voltage at 230 V	400 V
Nominal AC voltage at 240 V	415 V
AC voltage range*	160 V ... 280 V
Nominal AC current at 220 V	10.2 A
Nominal AC current at 230 V	10.2 A
Nominal AC current at 240 V	10.14 A
Maximum output current	10.2 A
Total harmonic factor of the output current at total harmonic factor of the AC voltage < 2%, and AC power > 50% rated power	≤ 3%
Rated power frequency	50 Hz
AC power frequency*	50 Hz/60 Hz
Operating range at AC power frequency 50 Hz	45.5 Hz ... 54.5 Hz
Operating range at AC power frequency 60 Hz	55.5 Hz ... 64.5 Hz
Displacement power factor cos φ, adjustable	0.8 overexcited ... 0.8 underexcited
Feed-in phases	3
Connection phases	3
Overvoltage category according to IEC 60664-1	III

* Depending on the configured country data set

Efficiency

Maximum efficiency, η_{max}	98%
Maximum efficiency, η_{EU}	97.4%

13.1.4 Sunny Tripower 8000TL

DC Input

Maximum DC power at cos φ = 1	8,200 W
Maximum input voltage*	1,000 V
MPP voltage range	330 V ... 800 V
Rated input voltage	580 V
Minimum input voltage	150 V
Initial input voltage	188 V
Maximum input current, input A	15 A
Maximum input current, input B	10 A
Maximum input current per string, input A**	15 A
Maximum input current per string, input B**	10 A
Number of independent MPP inputs	2
Strings per MPP input	2

* The maximum open-circuit voltage, which can occur if the cell temperature is at − 10°C, must not exceed the maximum input voltage.

** Maximum permitted current which may flow via one DC connector.

AC Output

Rated power at 230 V, 50 Hz	8,000 W
Maximum apparent AC power	8,000 VA
Rated grid voltage	230 V
Nominal AC voltage at 220 V	380 V
Nominal AC voltage at 230 V	400 V
Nominal AC voltage at 240 V	415 V
AC voltage range*	160 V ... 280 V
Nominal AC current at 220 V	11.6 A
Nominal AC current at 230 V	11.6 A
Nominal AC current at 240 V	11.11 A
Maximum output current	11.6 A
Total harmonic factor of the output current at total harmonic factor of the AC voltage < 2%, and AC power > 50% rated power	≤ 3%
Rated power frequency	50 Hz
AC power frequency*	50 Hz/60 Hz
Operating range at AC power frequency 50 Hz	45.5 Hz ... 54.5 Hz
Operating range at AC power frequency 60 Hz	55.5 Hz ... 64.5 Hz
Displacement power factor cos φ, adjustable	0.8 overexcited ... 0.8 underexcited
Feed-in phases	3
Connection phases	3
Overvoltage category according to IEC 60664-1	III

* Depending on the country data set

Efficiency

Maximum efficiency, η_{max}	98%
Maximum efficiency, η_{EU}	97.4%

13.1.5 Sunny Tripower 9000TL

DC Input

Maximum DC power at cos φ = 1	9,225 W
Maximum input voltage*	1,000 V
MPP voltage range	370 V ... 800 V
Rated input voltage	580 V
Minimum input voltage	150 V
Initial input voltage	188 V
Maximum input current, input A	15 A
Maximum input current, input B	10 A
Maximum input current per string, input A**	15 A
Maximum input current per string, input B**	10 A
Number of independent MPP inputs	2
Strings per MPP input	2

* The maximum open-circuit voltage, which can occur if the cell temperature is at − 10°C, must not exceed the maximum input voltage.

** Maximum permitted current which may flow via one DC connector.

AC Output

Rated power at 230 V, 50 Hz	9,000 W
Maximum apparent AC power	9,000 VA
Rated grid voltage	230 V
Nominal AC voltage at 220 V	380 V
Nominal AC voltage at 230 V	400 V
Nominal AC voltage at 240 V	415 V
AC voltage range*	160 V ... 280 V
Nominal AC current at 220 V	13.1 A
Nominal AC current at 230 V	13.1 A
Nominal AC current at 240 V	12.5 A
Maximum output current	13.1 A
Total harmonic factor of the output current at total harmonic factor of the AC voltage < 2%, and AC power > 50% rated power	≤ 3%
Rated power frequency	50 Hz
AC power frequency*	50 Hz/60 Hz
Operating range at AC power frequency 50 Hz	45.5 Hz ... 54.5 Hz
Operating range at AC power frequency 60 Hz	55.5 Hz ... 64.5 Hz
Displacement power factor cos φ, adjustable	0.8 overexcited ... 0.8 underexcited
Feed-in phases	3
Connection phases	3
Overvoltage category according to IEC 60664-1	III

* Depending on the configured country data set

Efficiency

Maximum efficiency, η_{max}	98%
European weighted efficiency, η_{EU}	97.5%

13.2 General Data

Width x height x depth with Electronic Solar Switch	470 mm x 730 mm x 240 mm
Weight	37 kg
Length x width x height of packaging	798 mm x 598 mm x 398 mm
Transport weight	40 kg
Climatic category (according to IEC 60721-3-4)	4K4H
Operating temperature range	– 25°C ... +60°C
Maximum permissible value for relative humidity, non-condensing	100%
Maximum operating altitude above MSL	3,000 m
Noise emission (typical)	≤ 40 dB (A)
Power loss in night operation	1 W
Topology	Transformerless
Cooling concept	OptiCool
Fan connection	Designed for safe disconnection in accordance with DIN EN 50178:1998-04
Degree of protection for electronics according to IEC 60529	IP65
Protection class (according to IEC 62103)	I
Licences (as per 06/2012)	CE, VDE-AR-N 4105, VDE0126-1-1/ UTE C15-712-1
Planned licences (as per 06/2012)	RD 1699, RD 661/2007, PPC, AS4777, EN 50438* , C10/11, MEA, PPDS, SI4777, G83/1-1, PEA

* Does not apply for all national appendices of EN 50438

13.3 Protective Devices

DC reverse polarity protection	Short-circuit diode
Input-side disconnection device	Electronic Solar Switch, SUNCLIX DC connector
DC overvoltage protection	Thermally monitored varistors
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 4
Maximum permissible fuse protection	32 A
Earth fault monitoring	Insulation monitoring: R_{iso} > 385 kΩ
All-pole sensitive residual-current monitoring unit	Available

13.4 Climatic Conditions

According to IEC 60721-3-4, Installation type C, Class 4K4H

Extended temperature range	– 25°C ... +60°C
Extended humidity range	0% ... 100%
Extended air pressure range	79.5 kPa ... 106 kPa

According to IEC 60721-3-2, Transport type E, Class 2K3

Temperature range	– 25°C ... +70°C

13.5 Features

DC connection	SUNCLIX DC connector
AC connection	Spring clamp terminal
Display	LC graphic display
Bluetooth® Wireless Technology	As standard
Speedwire with Webconnect function	As standard
Multi-function relay	As standard

13.6 Torques

Enclosure lid screws	6.0 Nm
Protective cover screws	2.0 Nm
Additional earth terminal	6.0 Nm
Cheese-head screw for attaching the enclosure to the wall mounting bracket	6.0 Nm
SUNCLIX swivel nut	2.0 Nm

13.7 Earthing Systems

IT system	Not suitable
TN-C system	Suitable
TN-S system	Suitable
TN-C-S system	Suitable
TT system, if U_{N_PE} < 30 V	Suitable
Split-phase	Not suitable

13.8 Data Storage Capacity

Daily energy yield performance	63 days
Daily yields	30 years
Event messages for users	250 events
Event messages for installers	250 events

13.9 Multi-Function Relay

Maximum AC switching voltage	240 V
Maximum DC switching voltage	30 V
Maximum AC switching current	1.0 A
Maximum DC switching current	1.0 A
Minimum electrical endurance when the maximum switching voltage and maximum switching current are complied with*	100,000 switching cycles

* Corresponds to 20 years with 12 switching operations per day

13.10 Electronic Solar Switch

Electrical endurance in the event of a short circuit, at nominal current of 30 A	At least 50 switching processes
Maximum switching current	30 A
Maximum switching voltage	1,000 V
Maximum PV power	9 kW
Degree of protection when plugged in	IP65
Degree of protection when removed	IP65

14 Accessories

You will find the corresponding accessories and spare parts for your product in the following overview. If required, you can order them from SMA Solar Technology AG or from your specialist dealer.

Description	Brief description	SMA order number
Electronic Solar Switch	ESS as spare part	ESS-HANDLE*
Insertion tool for replacement of varistors	Insertion tool for varistors	SB-TVWZ
Ventilation grid	Ventilation grid set (right and left) as spare part	45-7202
SUNCLIX DC connector	Field plug for conductor cross-sections of 2.5 mm² ... 6 mm²	SUNCLIX-FC6-SET

* When ordering a new ESS, always provide the device type and serial number of the inverter.

15 Contact

If you have technical problems concerning our products, contact the SMA Service Line. We require the following information in order to provide you with the necessary assistance:

- Inverter device type
- Inverter serial number
- Firmware version of the inverter
- Special country-specific settings of the inverter (if applicable)
- Type and number of the PV modules connected
- Mounting location and mounting altitude of the inverter
- 3-digit or 4-digit event number and display message
- Optional equipment, e.g. communication products
- Use of a multi-function relay

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